N00217.003362
HUNTERS POINT
SSIC NO. 5090.3

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN II)
Northern and Central California, Nevada, and Utah
Contract No. N62474-94-D-7609

Contract Task Order No. 011

Prepared for

U.S. DEPARTMENT OF THE NAVY
Naval Facilities Engineering Command
Engineering Field Activity West
San Bruno, California

PARCEL B FEASIBILITY STUDY
FINAL REPORT
HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA

November 26, 1996

Prepared by

PRC ENVIRONMENTAL MANAGEMENT, INC.
135 Main Street, Suite 1800
San Francisco, CA 94105
415/543-4880

Michael A. Johnson
for James M. Sickles, PRC Project Manager

PRC Environm
200 East Rand
Suite 4700
Chicago, IL 60601
312-856-8700
Fax 312-938-0116

November 26, 1996

Mr. Richard Powell
Department of the Navy
Engineering Field Activity West
Naval Facilities Engineering Command
900 Commodore Drive, Building 208
San Bruno, CA 94066-2402

Re: Replacement Pages for Draft Final Feasibility Study
Hunters Point Shipyard, Parcel B
CLEAN II, Contract Task Order No. 011

Dear Mr. Powell:

PRC Environmental Management, Inc. (PRC), has enclosed nine copies of replacement pages for the subject report. In addition, PRC has enclosed errata sheets describing which pages of the draft final feasibility study require replacement. At your direction, PRC has sent copies of the subject report to the distribution list below.

If you have any questions regarding this plan, please call me at (415) 222-8344.

Sincerely,

Michael A. Johnson

for James M. Sickles
PRC Installation Coordinator

Distribution:

U.S. Environmental Protection Agency (Attn: Anna-Marie Cook)
California Department of Toxic Substances Control (Attn: Cyrus Shabahari (w/2 copies)
California Regional Water Quality Control Board (Attn: Richard Hiett)

Copies to:

City and County of S.F., Dept. Of Public Health, Bureau of Toxics (Attn: Amy Brownell)
San Francisco City Attorney (Attn: John Cooper)
RAB Member: ARC Ecology (Attn: Saul Bloom)
Roy F. Weston, Inc. (Attn: Karla Brasaemle)
Kern Mediation Group (Attn: Douglas Kern)

ERRATA SHEET
HUNTERS POINT SHIPYARD, PARCEL B
DRAFT-FINAL FEASIBILITY STUDY
November 26, 1996

Replace in Draft-Final FS:	Sheets:	With following replacement sheets:
Cover Page	Cover Page	Cover Page
Table of Contents	i to xiii	i to xiv
Executive Summary	Not applicable	Figures ES-1 and ES-2
	Figure ES-3	Figure ES-3
Section 2	Table 2-5	Table 2-5
Section 4	Figure 4-2	Figure 4-2
Section 5	Pages 5-1 to 5-2	Pages 5-1 to 5-2
	Tables 5-5 to 5-10	Tables 5-5 to 5-10
Appendix H	Not applicable	Appendix H tab sheet

CONTENTS

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

Section | Page

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

Section | Page

FIGURES

FIGURES (Continued)

TABLES

TABLES (Continued)

TABLES (Continued)

APPENDI~~X~~CES

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

APC	Air pollution control
ARAR	Applicable or relevant and appropriate requirement
AS	Air sparging
AST	Aboveground storage tank
ATP	Anaerobic Thermal Processor
BAAQMD	Bay Area Air Quality Management Division
bgs	Below ground surface
BRAC	Defense Base Realignment and Closure Act of 1990
BTEX	Benzene, toluene, ethylbenzene, and xylene
CAA	Clean Air Act
Cal/EPA	California Environmental Protection Agency
CB	Cement-bentonite
CCR	California Code of Regulations
CDE	Cunningham-Davis, Environmental, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
Chromium III	Trivalent chromium
Chromium VI	Hexavalent chromium
CLEAN	Comprehensive Long-Term Environmental Action Navy
cm/s	Centimeter per second
COPC	Chemical of potential concern
CSPB	Controlled solid-phase biotreatment
CTO	Contract task order
CWA	Clean Water Act
DAF	Dilution and attenuation factor
DCA	Dichloroethane
DCE	Dichloroethene
DNAPL	Dense, nonaqueous-phase liquid
DoD	U.S. Department of Defense

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS (continued)

DSM	Deep soil mixing
DTSC	State of California Department of Toxic Substances Control
EE	Exploratory excavation
EE/CA	Engineering evaluation/cost analysis
EFA WEST	Engineering Field Activity West, Naval Facilities Engineering Command
ELCR	Excess lifetime cancer risk
ERA	Ecological risk assessment
FS	Feasibility study
ft^2	Square foot
gpm	Gallon per minute
gpd	Gallon per day
GRA	General response action
HDPE	High-density polyethylene
HDPP	High-density polypropylene
HGAL	Hunters Point groundwater ambient level
HHRA	Human health risk assessment
HI	Hazard index
HPS	Hunters Point Shipyard
HPAL	Hunters Point ambient level
IAS	Initial assessment study
IR	Installation restoration
IRP	Installation Restoration Program
LDR	Land Disposal Restrictions
LNAPL	Light nonaqueous-phase liquid
LUFT	Leaking underground fuel tank
MCL	Maximum contaminant level
MEK	Methyl ethyl ketone
mg/kg	Milligram per kilogram
mg/L	Milligram per liter
Moffett Field	Moffett Field Naval Air Station

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS (continued)

msl	Mean sea level
NACIP	Navy Assessment and Control of Installation Pollutants
NAPL	Nonaqueous phase liquid
Navy	U.S. Department of the Navy
NAWQC	National Ambient Water Quality Criteria
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRDL	Naval Radiological Defense Laboratory
O&M	Operation and maintenance
OSHA	Occupational Safety and Health Administration
PA	Preliminary assessment
PAH	Polynuclear aromatic hydrocarbon
PCA	Perchloroethane
PCB	Polychlorinated biphenyl
PCE	Perchloroethene
POP	Proof-of-process
POTW	Publicly owned treatment works
PPE	Personal protective equipment
PRC	PRC Environmental Management, Inc.
Presidio	Presidio of San Francisco
PRG	Preliminary remediation goal
PVC	Polyvinyl chloride
Q&RA	Quality and Reliability Assurance
QA/QC	Quality Assurance and Quality Control
RAO	Remedial action objective
RCRA	Resource Conservation and Recovery Act of 1976
RI	Remedial investigation
RME	Reasonable maximum exposure
ROD	Record of decision

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS (continued)

ROI	Radius of influence
RWQCB	California Regional Water Quality Control Board, San Francisco Bay Region
S/S	Stabilization/solidification
SARA	Superfund Amendments and Reauthorization Act of 1986
SB	Soil-bentonite
SDWA	Safe Drinking Water Act
SFDA	San Francisco District Attorney's Office
SFDPW	City and County of San Francisco Department of Public Works
SFPD	San Francisco Planning Department
SI	Site investigation
SoilTech	SoilTech ATP Systems, Inc.
STLC	Soluble threshold limit concentration
SVE	Soil vapor extraction
SVOC	Semivolatile organic compound
SPB	Slurry-phase biotreatment
SWPCP	Southeast Water Pollution Control Plant
SWQCB	State of California Water Quality Control Board
SWRCB	State of California Water Resources Control Board
TACAN	Tactical Air Navigation
TBC	Criteria to be considered
TCA	Trichloroethane
TCE	Trichloroethene
TCLP	Toxicity characteristic leaching procedure
TD	Thermal desorption
TDS	Total dissolved solids
TOG	Total oil and grease
TPH	Total petroleum hydrocarbon
TPH-d	Total petroleum hydrocarbon as diesel
TPH-g	Total petroleum hydrocarbon as gasoline
TPH-mo	Total petroleum hydrocarbon as motor oil

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS (continued)

Triple A	Triple A Machine Shop
TRPH	Total recoverable petroleum hydrocarbon
TSCA	Toxic Substances Control Act
TTLC	Total threshold limit concentration
U.S. EPA	U.S. Environmental Protection Agency
UST	Underground storage tank
VOC	Volatile organic compound
WESTDIV	Naval Facilities Engineering Command, Western Division
yd^3	Cubic yard
$\mu g/dL$	Microgram per deciliter
$\mu g/kg$	Microgram per kilogram
$\mu g/L$	Microgram per liter

EXECUTIVE SUMMARY

PRC Environmental Management, Inc. (PRC), received Contract Task Order (CTO) No. 011 under Comprehensive Long-Term Environmental Action Navy (CLEAN) II Contract No. N62474-94-D-7609 from the U.S. Department of the Navy (Navy), Engineering Field Activity West, Naval Facilities Engineering Command (EFA WEST), to conduct a remedial investigation (RI) and feasibility study (FS) at Parcels B and C of Hunters Point Shipyard (HPS) located in San Francisco, California. As the lead agency, the Navy has authority over the selection of the remedial alternative, the risk evaluation, and overall public participation activities at HPS. The Navy is working in cooperation with the U.S. Environmental Protection Agency (U.S. EPA) Region IX; the California Department of Toxic Substances Control (DTSC) Region 2; and the Regional Water Quality Control Board, San Francisco Bay Region (RWQCB), to develop and implement the selected remedial alternative. The RI for Parcel B was conducted from 1988 to 1996, and a draft-final RI report was completed on June 3, 1996. This FS was conducted concurrently with the RI to identify and screen technologies and evaluate alternatives for remediating Parcel B.

The purpose and organization of this FS report, background information, site investigations, removal actions, human health risk assessment (HHRA) results, FS results, and community participation activities are discussed below.

PURPOSE AND ORGANIZATION OF REPORT

The purpose of this FS report is to identify, screen, and evaluate remedial alternatives for Parcel B at HPS. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) states that the evaluation of remedial alternatives shall include an assessment of permanent solutions and alternative treatment technologies that, in whole or in part, will result in a permanent and significant decrease in the toxicity, mobility, or volume of the hazardous substance, pollutant, or contaminant. Furthermore, the NCP specifies that a remedial action shall be selected that is protective of human health and the environment, that is cost effective, and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. To prepare this report, PRC followed the "Draft Guidance for Conducting Remedial Investigations and Feasibility Studies" under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (U.S. EPA 1988) and the

NCP. The remedial alternatives that are evaluated in detail vary in (1) effectiveness in protecting human health and the environment, (2) implementability, and (3) cost.

This report consists of six sections. Section 1.0 is an introduction. Section 2.0 provides site characterization information for HPS and Parcel B, including (1) the history of HPS, (2) the facility setting of HPS, and (3) site characteristics for each of the 18 installation restoration (IR) and site investigation (SI) sites investigated during the Parcel B RI. Section 3.0 presents the remedial action objectives (RAO) and the estimated volume of Parcel B materials to be remediated and identifies and screens general response actions (GRA) and appropriate technology process options. In Section 4.0, alternatives are developed and screened from the process options retained after process option screening. Section 5.0 analyzes each of the retained alternatives in detail and compares the alternatives. Section 6.0 provides a list of references used to prepare this report.

BACKGROUND INFORMATION

In 1940, the U.S. Government received title to the land at Hunters Point and began developing it. From 1945 to 1974, the shipyard was predominantly used as a repair facility by the Navy. The Navy operated the shipyard as a carrier and ship repair facility through the late 1960s. HPS was deactivated in 1974 and remained relatively unused until 1976.

In 1976, the Navy leased 98 percent of HPS to a private ship repair company, the Triple A Machine Shop (Triple A). Triple A leased the property from July 1, 1976, to June 30, 1986. Triple A did not vacate the property until March 1987. During the lease period, Triple A used dry docks, berths, machine shops, power plants, various offices, and warehouses to repair commercial and Navy vessels. Triple A also subleased portions of the property to various other businesses. In 1986, the Navy resumed occupancy of HPS.

Parcel B consists of about 66 acres of northeast shoreline and lowland coast. Parcel B is bounded by Parcels A and C and San Francisco Bay. Historically, the dominant land use of Parcel B has been for office and commercial buildings and light industrial production. The future land-use pattern, as selected by the San Francisco Mayor's Citizen Advisory Council on June 2, 1994, is entitled "Education and Arts." Based on this land-use pattern, Parcel B is expected be zoned to accommodate mixed uses, including an industrial complex, an educational complex, a mixed residential/retail complex, and a cultural/historical district.

SITE INVESTIGATIONS

Eighteen study sites have been identified at HPS Parcel B. These sites include 16 IR sites and two SI sites. An IR site is one that has undergone a preliminary assessment (PA) and SI and is recommended for further study. An SI site is one that has also undergone the PA and SI stages but needs no further study.

Based on past activities and uses, the Navy identified areas at each of the 18 IR and SI sites at Parcel B where contaminants may have been released to soil or groundwater. Previous investigations show that two sites at Parcel B do not pose hazardous risks to human health or the environment and therefore did not require study during the RI phase. These two sites are SI-31, which consists of demolished Building 114 that was used for office space, and SI-45, which consists of an installation-wide steam line that provided steam heat to HPS buildings and warmed the fuel distribution lines to help oil flow.

Because of the presence of hazardous materials from past shipyard operations at HPS, the property was placed on the National Priorities List in 1989 as a Superfund site pursuant to Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). In 1991, HPS became slated for closure pursuant to the terms of the Defense Base Realignment and Closure Act of 1990 (Public Law 101-510). Closure activities at HPS involve environmental remediation activities and making the property available for nondefense use. The draft-final RI report dated June 3, 1996, indicates that soil and groundwater at Parcel B contain hazardous substances, including metals, volatile organic compounds (VOC), semivolatile organic compounds (SVOC), and petroleum hydrocarbons at concentrations that may pose a risk to future residents and workers at HPS and to environmental receptors residing in San Francisco Bay. Table ES-1 summarizes the types of contaminants detected in soil and groundwater and the estimated volume of contaminated soil requiring remediation at each of the IR and SI sites.

REMOVAL ACTIONS

Several removal actions have or will be conducted to address soil contamination at IR-06 (Former Buildings 111 and 112; and Tank Farm), IR-23 (Building 146, Tactical Air Navigation Facility; Building 61, Maintenance Service; and Building 162, Paint Storage), IR-26 (Building 157, Nondestructive Testing Laboratory and Area XIV), and IR-50 (Storm Drain and Sanitary Sewer Systems). Table ES-2 summarizes the removal actions.

HUMAN HEALTH RISK ASSESSMENT RESULTS

Analytical results from the field investigation were used to evaluate potential risks and hazards to human health. The HHRA for Parcel B indicates that future residential receptors may be exposed to hazardous substances in soil through ingestion of and dermal contact with this soil, ingestion of produce grown in the soil, and inhalation of volatile emissions from soil and soil particles in air. The RWQCB has indicated that Parcel B groundwater is unlikely to be used as a potable drinking water source in the future; however, future residents and workers may be exposed to VOCs from groundwater through inhalation of VOCs that volatilize from groundwater, through soil, and into future buildings through cracks in the walls and foundations. HHRA results related to risks and hazards posed to future workers and future residents at Parcel B are described below.

Future Workers

Risks to future workers were assessed with respect to carcinogenic risks, noncarcinogenic hazards, risks from lead exposure, and risks and hazards from inhalation of chemicals of potential concern (COPC) from A-aquifer groundwater. HHRA results for the reasonable maximum exposure (RME) case for the 90 0.5-acre industrial land-use exposure areas at Parcel B are summarized below.

Carcinogenic risks: Carcinogenic risks related to exposure to soil exceeded U.S. EPA's acceptable excess lifetime cancer risk (ELCR) range of 10^{-4} to 10^{-6} in only 3 out of 90 exposure areas. ELCRs were within U.S. EPA's acceptable risk range for 49 exposure areas and below the acceptable risk range for 38 exposure areas. The COPCs contributing most to the ELCRs were Aroclor-1260, arsenic, polynuclear aromatic hydrocarbons (PAH), and trichloroethene. Dermal contact with and ingestion of soil were the dominant exposure pathways in all exposure areas except for one area where trichloroethene contributed most significantly to carcinogenic risk. In that exposure area, inhalation was the major exposure pathway. Figure ES-1 shows the ELCR of each half-acre exposure area in Parcel B.

Noncarcinogenic hazards: Total segregated hazard indexes (HI) under the RME case exceeded the target of 1 for only 2 out of 90 exposure areas. These exposure areas are B004 in IR-18 and B287 in IR-26. The COPCs responsible for noncarcinogenic hazards were Aroclor-1254 and arsenic.

Risks from lead exposure: RME soil lead concentrations exceeded the target level of 1,000 milligrams per kilogram (mg/kg) in 3 out of 90 exposure areas in Parcel B. These exposure areas are B021 in IR-07 (1,200 mg/kg), B103 in IR-23 (1,100 mg/kg), and B287 in IR-26 (3,300 mg/kg).

Risks and hazards from inhalation of COPCs in groundwater: Indoor air concentrations of all COPCs measured within Building 134 in IR-25 were at least three orders of magnitude below Occupational Safety and Health Administration permissible exposure limits. Indoor air concentrations of COPCs within Building 134 are likely to be higher than for other Parcel B buildings because Building 134 is poorly ventilated and is constructed over the portion of the shallow A-aquifer containing the highest groundwater VOC concentrations.

Future Residents

Risks to future residents were assessed with respect to carcinogenic risks, noncarcinogenic hazards, risks from lead exposure, and risks and hazards from inhalation of COPCs from A-aquifer groundwater. HHRA results for the RME case for the 227 2,500-square-foot exposure areas at Parcel B are summarized below.

Carcinogenic risks: The HHRA calculated ELCRs for 227 exposure areas within Parcel B. Under the RME case, carcinogenic risks from soil-related exposure exceeded 10^{-4} in 36 exposure areas. These exposure areas are located in IR-06, IR-07, IR-10, IR-18, IR-23, IR-24, IR-25, IR-26, and IR-42. ELCRs were within U.S. EPA's 10^{-4} to 10^{-6} acceptable risk range in 86 exposure areas and were lower than 10^{-6} in 105 exposure areas. The COPCs most responsible for carcinogenic risk were Aroclor-1254, Aroclor-1260, PAHs, arsenic, beryllium, aldrin, trichloroethene, and hexavalent chromium (chromium VI). Ingestion of homegrown produce was the dominant exposure pathway in exposure areas where polychlorinated biphenyls (PCB) and PAHs contributed most significantly to the ELCRs. In exposure areas where metals contributed most to the ELCR, soil ingestion and ingestion of homegrown produce were the dominant exposure pathways. Figure ES-2 shows the ELCR for each 2,500-square-foot exposure area in Parcel B.

Noncarcinogenic hazards: Total segregated HIs for soil-related exposure pathways exceeded 1 in 103 out of 227 exposure areas. HIs were calculated for child residents, the most sensitive potential receptors. The COPCs most responsible for noncarcinogenic hazards were antimony, arsenic, copper, manganese, mercury, nickel, zinc, trichloroethene, and Aroclor-1254. Ingestion of both homegrown produce and soil were the dominant exposure pathways.

Risks from lead exposure: RME soil lead concentrations exceeded the target value of 221 mg/kg in only 24 out of 227 exposure areas. Most of these 24 exposure areas are located in IR-06, IR-07, and IR-18. The other IR sites where soil lead concentrations exceeded 221 mg/kg in at least one exposure area are IR-20, IR-23, IR-24, IR-25, and IR-26.

Risks and hazards from inhalation of COPCs in groundwater: VOCs were detected in A-aquifer groundwater samples collected from 38 exposure areas. Under the future residential land-use scenario, it was assumed that residences would be constructed over these portions of the A-aquifer. In four exposure areas, indoor air concentrations calculated from groundwater VOC concentrations exceeded the U.S. EPA Region IX ambient air preliminary remediation goals (PRG). These exposure areas are B3730 in IR-06, B3824 in IR-24 and IR-25, B3825 in IR-24 and IR-25, and B3828 in IR-06. For the RME case in exposure area B3824, vinyl chloride; 1,2-dichloroethane; and tetrachloroethene concentrations exceeded their respective ambient air PRGs. For the RME case in the other three exposure areas, only the vinyl chloride concentration exceeded its PRG. These results indicate a potential risk to future residents from inhalation of COPCs in indoor air from the A-aquifer in a localized area of Parcel B.

FEASIBILITY STUDY RESULTS

Under the FS process, remedial alternatives are developed by assembling medium-specific technologies into cleanup alternatives. The process consists of following general steps:

1. Development of RAOs that specify the contaminants and media of interest, exposure pathways, and remediation goals to develop a range of treatment and containment

alternatives; RAOs are developed on the basis of chemical-specific applicable or relevant and appropriate requirements (ARAR) and human health and ecological risk assessment (ERA) results

2. Development of GRAs for each medium that define containment, removal, treatment, disposal, or other actions, singly or in combination, that satisfy the RAOs

3. Identification of volumes or areas of contaminated media to which GRAs apply

4. Identification and screening of remedial technologies for each GRA to eliminate those that cannot be technically implemented; GRAs are then further defined to specify remedial technology types (for example, the GRA for treatment can be further defined to include chemical or biological technology types)

5. Identification and screening of process options for each remedial technology to select a representative remediation process; although specific processes are selected for alternative development and evaluation, these processes are intended to represent the broader range of process options within a general technology type (for example, chemical oxidation and dechlorination are chemical treatment process options)

6. Assembly of process options into a range of alternatives, screening of the alternatives, and evaluation of retained alternatives

RAOs, identification of areas requiring remediation, and the development and screening of remedial alternatives, are discussed below, followed by a detailed individual analysis of remedial alternatives and comparative analysis of alternatives.

Remedial Action Objectives

The first step in developing remedial alternatives involves the identification of RAOs. The two media of concern at HPS Parcel B are contaminated soil and contaminated groundwater. To address both areas of concern, RAOs were developed for identifying, developing, and evaluating remedial alternatives. RAOs are medium-specific goals for protecting human health and environment. RAOs include both an exposure route and a contaminant concentration because protectiveness can be achieved in two ways: by limiting or eliminating the exposure pathway or by reducing contaminant concentrations. The FS report evaluates remedial alternatives for both approaches.

The RAOs for Parcel B are based on information from the RI report and the HHRA in accordance with the NCP. An ERA is being prepared and is expected to be available in late 1996.

The results of the HHRA show that the principal threats to human health under a future residential land-use scenario result from the dermal contact, inhalation, and ingestion pathways. The RAO for contaminated soil has three parts:

- Prevent ingestion of, direct contact with, or inhalation of carcinogenic hazardous substances in soil from 0 to 10 feet below the ground surface (bgs) resulting in an ELCR exceeding 10^{-4} to 10^{-6}
- Prevent ingestion of, direct contact with, or inhalation of noncarcinogenic hazardous substances in soil from 0 to 10 feet bgs resulting in an HI exceeding 1
- Prevent ingestion of, direct contact with, or inhalation of lead in soil from 0 to 10 feet bgs at concentrations that may cause unacceptable blood-lead levels

The NCP establishes an acceptable risk range of 10^{-4} to 10^{-6}. A range of soil cleanup goals was developed to consider and evaluate remediation of Parcel B areas to levels of various protection based on U.S. EPA's acceptable risk range and future land use. Each level of protection, or cleanup goal scenario, may have a different implementation period and cost; therefore, this FS report provides information needed to evaluate whether the incremental time and cost required to remediate Parcel B areas to allow residential use are commensurate with the benefits associated with residential land use versus land uses such as industrial use. The six cleanup goal scenarios evaluated in the FS report are presented in Table ES-3.

Groundwater and surface water at HPS have not been used for domestic drinking water, industrial, or irrigation purposes in the past and are not likely to be used as such in the future; therefore, no RAO was developed for the drinking water pathway.

The human health RAO for contaminated groundwater has just one element: to prevent inhalation of VOCs from contaminated groundwater resulting in an ELCR of greater than 10^{-4} to 10^{-6}. The RAO for protection of the environment from contaminated groundwater was developed to protect the environment from contaminants flowing into San Francisco Bay. National Ambient Water Quality Criteria (NAWQC) and water quality criteria in the San Francisco Bay Basin Water Quality Control Plan are used as cleanup goals for groundwater entering the bay from Parcel B except for chemicals with Hunters Point groundwater ambient levels (HGAL) exceeding water quality criteria. For chemicals with HGALs exceeding water quality criteria, the HGALs are the RAOs.

Identification of Areas Requiring Remediation

Results from the RI were used to identify Parcel B areas that require remediation and calculate volumes requiring remediation. For the purposes of this FS, areas requiring remediation are categorized as "remediation areas" and "*de minimus* areas." Areas that contain hazardous substances in soil at distinct, relatively high concentrations are referred to as remediation areas. Remediation areas generally have one or more of the following characteristics:

- High metal concentrations compared to Hunters Point ambient levels (HPAL)
- Hazardous substance concentrations that cause a potentially unacceptable risk or hazard
- Multiple contaminants
- Chemicals in soil similar to chemicals typically associated with wastes managed at Parcel B

De minimus areas contain isolated, relatively low concentrations of hazardous substances. Specific sources of contamination could not be identified at many of these exposure areas. *De minimus* cleanup areas generally have one or more of the following characteristics:

- Hazardous substance concentrations close to HPALs
- Hazardous substance concentrations that cause an ELCR between 10^{-6} and 10^{-4} or an HI near 1
- A single contaminant
- No known source of contaminants
- No distinguishable pattern of contaminants in soil

Figure ES-3 shows the locations of soil remediation areas at Parcel B.

Areas requiring groundwater remediation were identified by comparing chemical concentrations in groundwater to water quality criteria and HGALs. Groundwater at four IR sites, IR-06, IR-07, IR-10, and IR-25, contain concentrations of chemicals exceeding water quality criteria and HGALs. However, groundwater modeling and groundwater monitoring results indicate that at only one IR site, IR-07, chemical concentrations exceed water quality criteria and HGALs at the groundwater/surface water interface, which is the point of compliance for evaluating compliance with water quality criteria. In addition, groundwater at one location, IR-25, contains VOC concentrations that may present a risk to the health of future residents. Therefore, the groundwater alternatives address groundwater contamination at IR-07 and IR-25.

For this FS, a parcel-wide approach was taken to develop remedial alternatives. In each parcel, a number of sites were identified and were investigated during the RI. Many of the IR sites within Parcel B contain similar hazardous substances. Contaminated media are therefore grouped in this FS based on waste and contaminant type as follows to facilitate screening of remedial technologies and process options:

- Soil containing inorganic compounds, including metals and cyanide
- Soil containing SVOCs, including PAHs, PCBs, and pesticides
- Soil containing VOCs
- Soil containing dense, nonaqueous-phase liquids (DNAPL), including nonaqueous phase VOCs and SVOCs
- Soil containing both organic (VOCs, SVOCs, or petroleum hydrocarbons) and inorganic compounds (metals or cyanide)
- Contaminated groundwater in the A-aquifer

Table ES-4 presents estimated volumes of soil and groundwater requiring remediation for each type of contaminated medium described above.

Development and Screening of Alternatives

The FS screening process described in Steps 4 and 5 of the introduction to this section was conducted to identify potentially feasible process options to assemble into remedial alternatives for soil and groundwater. Eight remedial alternatives for soil and seven remedial alternatives for groundwater (see Tables ES-5 and ES-6) were assembled using the process options retained for remedial alternative development. These alternatives would be implemented on a parcel-wide basis, depending on the type of hazardous substances present at each IR site. The remedial alternatives were screened based on their relative effectiveness, implementability, and cost. Remedial alternatives retained for detailed analysis for soil (Alternatives S-1 through S-4, S-6, and S-8) and groundwater (Alternatives GW-1 through GW-3 and GW-5) are presented below.

Alternative S-1: No Action

Under this alternative, no remedial action would be taken. Rather, Parcel B soil would be left as is, without implementation of institutional controls, containment, treatment, or removal.

Alternative S-2: Excavation and Off-Site Incineration of DNAPL-Contaminated Soil; Excavation and Off-Site Disposal of All Other Soils

Under this alternative, all soil presenting a potential human health risk exceeding cleanup goals would be excavated. Based on data collected during the RI, the total volume of soil to be excavated is estimated to be 4,600 cubic yards (yd^3) under cleanup goal scenario 6 to 38,500 yd^3 under cleanup goal scenario 1.

The Navy estimates that approximately 500 yd^3 of DNAPL-containing soil may be located beneath the sump at IR-25. During the remedial design phase, sampling data would be collected to determine the extent of the DNAPL-contaminated soil. The sump would be demolished and transported off site for disposal. The DNAPL-contaminated soil would then be excavated from the sump area and transported off site for incineration. Soil from other areas would be excavated and disposed off site in either a Class I or Class II landfill. Clean backfill would be used to restore the excavated areas.

For areas requiring large excavations, primarily sites IR-07 and IR-18, stockpile management areas may be established. In these areas, run-on and run-off controls would be implemented and collected runoff would be stored on site, sampled, and discharged to the publicly owned treatment works (POTW) or shipped off site for disposal.

The primary ARARs for this alternative are specific requirements under the California Hazardous Waste Control Act for management of hazardous waste. Prior to excavation, the soil would be sampled in accordance with the hazardous waste identification regulations in 22 California Code of Regulations (CCR), Section 66261, to determine if the excavated soil must be managed as a hazardous waste. If the soil exhibits a hazardous waste characteristic and is stored on site, the corrective action management unit (CAMU) or temporary unit (TU) requirements in 22 CCR, Sections 66264.552 and 66264.553, would be followed. Finally, as appropriate, soil would be evaluated as required by 22 CCR, Section 66268.7(a), to determine if it is subject to land disposal restrictions.

Soil containing hazardous substances that exhibit hazardous waste characteristics under federal or state law would be disposed of in a Class I landfill; soil that does not exhibit hazardous waste characteristics would be disposed in a Class II landfill. Based on RI data, 400 yd^3 of soil under cleanup goal scenario 6 to 1,600 yd^3 of soil under cleanup goal scenario 1 would be disposed of at a Class I landfill and 3,600 yd^3 of soil under cleanup goal scenario 6 to 36,400 yd^3 of soil under cleanup goal scenario 1 would be disposed of at a Class II landfill.

Alternative S-3: Excavation and Off-Site Incineration of DNAPL-Contaminated Soil; Soil Vapor Extraction; and Excavation and On-Site Placement or Off-Site Disposal of SVOC- and Inorganic-Contaminated Soil in Landfills

Under Alternative S-3, except for VOC-contaminated soil at IR-10 and IR-25, contaminated soil would be excavated and disposed of off site or placed on site at the IR-1/21 landfill in Parcel E. Excavation would proceed as described above under Alternative S-2.

Soil containing only VOCs would be treated on site by soil vapor extraction (SVE). During SVE, slotted or drilled pipes, or extraction wells, are installed installed and a vacuum is applied to the well to removed volatile compounds. The removed soil vapor is treated using activated carbon to remove the contaminants to acceptable levels. Based on RI data, the only areas in which SVE would be conducted are at IR-10 and IR-25. Approximately 1,100 yd^3 of soil would be treated by SVE under cleanup goal scenarios 1 through 5, and SVE would not be required under cleanup goal scenario 6. Because of the distance between the two IR sites, separate systems would be installed at IR-10 and IR-25. Two vertical SVE wells would be installed at IR-10, and one well would be installed at IR-25. If predesign sampling data indicate a greater area of contamination than currently estimated at IR-10, additional SVE wells may be installed.

A total of 4,600 yd^3 of soil under cleanup goal scenario 6 to 37,400 yd^3 of soil under cleanup goal scenario 1 would be excavated under Alternative S-3. The excavation and off-site treatment of the DNAPL-contaminated soil at IR-25 would be conducted as described above under Alternative S-2. Soil from all areas except IR-10 and IR-25 would be excavated, sampled, and analyzed. Soil that contains hazardous substances at concentrations below the criteria listed in Table ES-7 would be used as sub-base material for the cap foundation at the IR-1/21 landfill in Parcel E, assuming that capping is the selected remedy for IR-1/21. Soil destined for placement at the landfill may be stored until a final decision on the remedy for the landfill is reached. Because the soil does not contain hazardous waste, Resource Conservation and Recovery Act of 1976 (RCRA) requirements for storing the soil would not apply. Soil exceeding the criteria for on-site placement would be sent off site to either a Class I or Class II landfill for disposal. Based on the RI, approximately 500 yd^3 of DNAPL-contaminated soil would be incinerated off site; 400 yd^3 of soil under cleanup goal scenario 6 to 1,600 yd^3 of soil under cleanup goal scenario 1 would be disposed in a Class I landfill; 1,800 yd^3 of soil under cleanup goal scenario 6 to 17,200 yd^3 of soil under cleanup goal scenario 1 would be disposed in a Class II landfill; and 1,800 yd^3 of soil under cleanup goal scenario 6 to 18,000 yd^3 of soil under cleanup goal scenario 1 would be placed at the IR-1/21 landfill. The excavated areas will be filled with clean backfill.

The major ARARs associated with this alternative are the hazardous waste requirements described above under Alternative S-2. For the SVE component of this alternative, Bay Area Air Quality Management District (BAAQMD) Regulation 8-47 is an ARAR, and the miscellaneous unit requirements under hazardous waste regulations in 22 CCR, Section 66264.600, are potential ARARs if the concentrations of contaminants in soil treated by SVE indicate that the soil is a hazardous waste. BAAQMD Regulation 8-47 requires that emission controls be implemented if the emissions exceed 1 pound per day for selected VOCs.

Alternative S-4: Excavation and Off-Site Incineration of DNAPL-Contaminated Soil; SVE; Excavation and Off-Site Disposal of Soil Containing Hazardous Waste in Landfill; Excavation, On-Site Asphalt Encapsulation, and Stabilization of SVOC- and Inorganic-Contaminated Soil; and On-Site Placement of Stabilized Soil

Alternative S-4 is similar to Alternative S-3 except that on-site asphalt encapsulation and stabilization would be used to treat excavated soils that do not exhibit hazardous waste characteristics. The treated soil would then be placed at the IR-1/21 landfill.

Excavation would be conducted as described above under Alternative S-2. Soil containing DNAPLs would be shipped off site for incineration as described above under Alternative S-2. At IR-10 and IR-25, soil containing only VOCs would be treated on site using SVE as described above under Alternative S-3.

The remaining soil would contain SVOCs, inorganics, or combined organics and inorganics. Soil that contains concentrations that exceed the cleanup goal (4,600 yd^3 of soil under cleanup goal scenario 6 to 37,400 yd^3 of soil under cleanup goal scenario 1) would be excavated. Excavated soil that exhibits hazardous waste characteristics (400 yd^3 of soil under cleanup goal scenario 6 to 1,600 yd^3 of soil under cleanup goal scenario 1) would be shipped off site for disposal at a Class I landfill. The remaining soil (3,600 yd^3 of soil under cleanup goal scenario 6 to 35,300 yd^3 of soil under cleanup goal scenario 1) would be stabilized, encapsulated, and placed at the IR-1/21 landfill. Under stabilization and encapsulation, contaminated soil would be mixed with reagents to form a hard, asphalt-like substance to prevent hazardous substances from leaching. During the design phase, bench-scale tests and treatability studies would be performed to identify the most appropriate technology process, operating conditions, and pretreatment requirements.

As described above under Alternatives S-2 and S-3, the major ARARs for this alternative are (1) hazardous waste regulations relating to hazardous waste identification, (2) related to storage under the CAMU and TU rules, (3) related to treatment in miscellaneous units, (4) related to determination of whether the land disposal restrictions apply, and (5) BAAQMD Regulation 8-47 for the SVE system.

Alternative S-6: Excavation, On-Site Thermal Desorption of DNAPL-, VOC-, SVOC-Contaminated Soil and Soil Replacement; Excavation, On-Site Thermal Desorption, and Solidification/Stabilization of Inorganic- and Organic-Contaminated Soil, and On-Site Placement; and Excavation and Solidification/Stabilization of Soil Containing Inorganics, and On-Site Placement

Under Alternative S-6, all soil containing contaminant concentrations exceeding cleanup goals would be excavated and treated. Excavation would be conducted as described above under Alternative S-2. The treatment technology and ultimate disposition of the treated soil would depend on the hazardous substances in the soil.

Soil containing DNAPLs or organics only would be treated using thermal desorption. Thermal desorption operates similar to an oven to "bake" or vaporize contaminants from soil in a heating chamber such as a kiln. However, unlike incineration, a heating source such as heated air or the heated walls of the kiln heat the soil in low-oxygen conditions to promote vaporization of chemicals, as compared to incineration that directly heats soil using combustion. Vaporized chemicals are removed in an off-gas treatment system. If the treated soil meets cleanup goals, the soil would be replaced in the excavated areas at Parcel B.

Soil containing both organics and inorganics would also be treated by thermal desorption. The treated soil would then be combined with soil containing only inorganics and solidified and stabilized. The stabilized soil would then be placed at the IR-1/21 landfill. Clean backfill would be placed in the excavated areas.

The primary ARARs are the hazardous waste requirements. The thermal desorption unit would be operated in accordance with the requirements for miscellaneous units under 22 CCR, Section 66264.600. Oil or condensed organic treatment residuals from the thermal desorption unit would be shipped off site for disposal at a Class I landfill. Other solid waste streams, such as cyclone and baghouse fines, are typically treated and placed with the treated soil.

Under this alternative, 600 yd^3 of soil under cleanup goal scenario 6 to 13,600 yd^3 of soil under cleanup goal scenario 1 would be treated by thermal desorption and 3,500 yd^3 of soil under cleanup goal scenario 6 to 25,100 yd^3 of soil under cleanup goal scenario 1 would be solidified and stabilized. A total of 4,200 yd^3 of treated soil under cleanup goal scenario 6 to 30,100 yd^3 of treated soil under cleanup goal scenario 1 would be placed at the IR-1/21 landfill.

Alternative S-8: Excavation and Incineration of DNAPL-Contaminated Soil; Asphalt Cap at IR-07 and IR-18; and Excavation of Contaminated Soil at IR Sites Other Than IR-07 and IR-18 and Off-Site Disposal in Landfill

Alternative S-8 involves capping contaminated soil at two locations and excavating and disposing of contaminated soil off site as described above under Alternative S-2 for all other areas. This alternative would be implemented in conjunction with groundwater alternative GW-5 as described below.

Under the capping component of this alternative, the existing soil cap at IR-07 and IR-18 would be removed and replaced with a new asphalt cap. The cap would extend over approximately 600,000 square feet and cover contaminated soil at IR-07 and IR-18. Monitoring of the cap would be required to ensure its integrity. In addition, institutional controls would be implemented to minimize disturbance of the cap.

Under this alternative, approximately 500 yd^3 of soil containing DNAPLs would be incinerated; 400 yd^3 of soil under cleanup goal scenario 6 to 1,600 yd^3 of soil under cleanup goal scenario 1 would be disposed of in an off-site Class I landfill; and 130 yd^3 of soil under cleanup goal scenario 6 to 3,500 yd^3 of soil under cleanup goal scenario 1 would be disposed of in an off-site Class II landfill.

Alternative GW-1: No Action

Under this alternative, no action would be taken to address groundwater contamination. Rather, contaminated groundwater would be left "as is."

Alternative GW-2: Deed Restrictions; Removal of Groundwater Containing DNAPLs; Lining of Storm Drains; Removal of Steam Lines and Fuel Lines; and Groundwater Monitoring

Alternative GW-2 consists of several components. First, even though future groundwater use is unlikely, under this alternative, deed restrictions would be placed to prohibit future groundwater use. Second, groundwater containing DNAPLs removed during the soil remedial action at IR-25 would be shipped off site for treatment and disposal. Third, potential preferential pathways for direct groundwater discharge to the bay would be eliminated. Specifically, sections of the storm drains located below the groundwater table would be lined to prevent groundwater from infiltrating into the system and discharging to San Francisco Bay. Sections of the storm drains to be lined are located at IR-07, IR-10, and IR-25; the specific sections of the system will be determined during a removal action currently underway. In areas requiring lining, the bedding material would be pressure grouted. Fuel and steam lines, which may also act as pathways, would also be removed under this alternative. Stained soil encountered during the fuel line removal would be excavated and treated as part of the selected soil alternative or in accordance with the HPS petroleum corrective action plan. Steam lines would be pulled from utility corridors at Parcel B.

Groundwater monitoring would be implemented to track hazardous substance migration toward San Francisco Bay. Approximately 10 wells spaced about 300 feet apart would be installed to monitor groundwater migration from IR-07, IR-10, and IR-25. The monitoring wells would be located to allow sufficient time (approximately 5 years) to undertake remedial action if concentrations at the tidally influenced zone apparently exceed metals HGALs or federal water quality criteria for organics.

During remedial design, the Navy would prepare a contingency plan that describes actions that would be taken if groundwater monitoring criteria are exceeded. After the first exceedance, the Navy will notify the agencies and the caretaker/owner of the property (if not the Navy). If the groundwater monitoring criteria are exceeded for three consecutive sampling events, the Navy will prepare and submit a plan to mitigate release of contaminants to the bay at concentrations exceeding groundwater cleanup criteria. The Navy will also conduct community participation activities, such as preparing fact sheets, to notify the community of actions that will be taken at Parcel B.

Alternative GW-3: Deed Restrictions; Removal of Groundwater Containing DNAPLs; Lining of Storm Drains; Removal of Steam lines and Fuel Lines; Groundwater Monitoring; and Groundwater Extraction, Pretreatment, and Discharge to POTW from IR-07 and IR-25

In addition to all the actions described above under Alternative GW-2, GW-3 would involve extraction of A-aquifer groundwater from IR-07 and IR-25. At IR-07, the extraction system would consist of seven wells with a combined pumping rate of 17.5 gallons per minute (gpm). At IR-25, the extraction system would also consist of seven wells with a combined pumping rate of 12.5 gpm. Modeling data indicate that the IR-07 system would operate for 30 years. At IR-25, the system is estimated to operate for a minimum of 3 years. As necessary, the collected groundwater would first be treated by equalization; total petroleum hydrocarbons (TPH) and DNAPLs that settle out would be shipped off site for treatment and disposal. The groundwater would then be treated using air stripping prior to discharge to the local POTW for treatment and disposal. Discharge to the POTW would depend on whether the discharge meets the POTW's limitations and is accepted by the POTW.

The main ARARs associated with this alternative are action-specific and include the hazardous waste regulations and the BAAQMD requirements under Regulation 8-47 for air strippers. The extracted groundwater would be analyzed in accordance with the requirements in 22 CCR, Sections 66261.21 through 66261.24, to determine if it must be managed as a hazardous waste. If the extracted groundwater contains hazardous substances at concentrations exceeding the hazardous waste characteristic criteria, the hazardous waste requirements for miscellaneous units under 22 CCR, Section 66264.600, and for air emissions from process vents under 22 CCR, Sections 66264.1030 through 66264.1034, may be ARARs.

Alternative GW-5: Deed Restrictions; Removal of Groundwater Containing DNAPLs; Lining of Storm Drains; Removal of Steam Lines and Fuel Lines; Groundwater Monitoring; Groundwater Extraction, Pretreatment, and Discharge from POTW at IR-25; and Slurry Wall Containment and Cap at IR-07

Under Alternative GW-5, all the actions described above under Alternative GW-2 would be implemented and a groundwater extraction, treatment, and disposal system would operate at IR-25 as described above under Alternative GW-3. In addition, this alternative includes installation of a 2,000-foot-long soil-bentonite slurry wall at IR-07. The slurry wall would extend approximately to 40 feet bgs to the Bay Mud Deposits or bedrock. Short-term permeability testing and long-term compactability testing would be required to develop the appropriate mixture of native soil, bentonite, and water for the slurry wall. This alternative would be implemented in conjunction with soil alternative S-8 as described above, which proposes an asphalt cap at IR-07.

The main ARARs for this alternative are the same as those described above under Alternative GW-3.

Detailed Individual Analysis of Alternatives

Each soil and groundwater alternative retained after remedial alternative development and screening were evaluated in detail based on the seven criteria discussed below.

- Overall protection of human health and the environment -- This criterion describes how each alternative as a whole protects human health and the environment and indicates how each hazardous substance source is to be eliminated, reduced, or controlled.

- Compliance with ARARs -- This criterion evaluates each alternative's compliance with ARARs, or, if an ARAR waiver is required, how the waiver is justified. ARARs consider location-, chemical-, and cleanup action-specific concerns.

- Long-term effectiveness and permanence -- This criterion evaluates the effectiveness of each alternative in protecting human health and the environment after the remedial action is complete. Factors considered include magnitude of residual risks and adequacy and reliability of release controls.

- Reduction of toxicity, mobility, or volume through treatment -- This criterion evaluates the anticipated performance of each alternative's specific treatment technologies to reduce the toxicity, mobility, or volume of hazardous substances.

- Short-term effectiveness -- This criterion examines the effectiveness of each alternative in protecting human health and the environment during the construction and implementation period. Four factors are considered when assessing the short-term effectiveness of an alternative: protection of the community during remedial actions, protection of workers during remedial actions, environmental impacts of remedial actions, and time required to complete remedial actions.

- Implementability -- This criterion evaluates the technical and administrative feasibility of each alternative and the availability of required resources.

- Cost -- This criterion evaluates the capital, operation and maintenance, and present worth costs of each alternative. The present worth cost is presented as the net present value.

The two criteria of state and community acceptance are not addressed in this draft-final FS report. State acceptance will be addressed by DTSC's review and approval of this draft-final FS report. Evaluation of community acceptance will not be completed until comments on the proposed plan for Parcel B are received. Tables ES-8 and ES-9 summarize and compare the remedial alternatives with respect to the seven evaluation criteria.

Comparative Analysis of Alternatives

A comparative analysis was conducted to evaluate the relative performance of each alternative in relation to the evaluation criteria. Overall protection of human health and the environment and compliance with ARARs are the threshold criteria that must be satisfied in order for a remedy to be eligible for selection. Long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementability; and cost are the primary balancing criteria used to evaluate the comparative advantages and disadvantages of the remedies. Regulatory agency and community acceptance are modifying criteria. Table ES-10 presents a summary of how the soil alternatives compare to each other, and Table ES-11 presents a summary of how the groundwater alternatives compare to each other. The comparison of the soil and groundwater alternatives is presented below.

Soil Alternatives

Overall Protection of Human Health and the Environment: All of the alternatives except Alternative S-1, no action, would protect human health and the environment by eliminating, reducing, or controlling risks through a combination of treatment, engineering controls, or institutional controls. Alternatives S-2 through S-8 would eliminate the risks associated with DNAPLs at IR-25 by excavation and off-site treatment and disposal. Except for the DNAPL-contaminated soil, Alternatives S-2 and S-8 would rely primarily on on- or off-site containment to reduce risks, whereas Alternatives S-3, S-4, and S-6 would also incorporate treatment as part of the remedy.

Compliance with ARARs: No federal or state chemical-specific ARARs regulate implementation of any of the soil alternatives. Instead, soil would be remediated to meet the health-based cleanup goal of 10^{-4} to 10^{-6} or HPALs. All the alternatives would be implemented to meet their respective action- and location-specific ARARs.

Long-Term Effectiveness and Permanence: Alternative S-1 would provide no long-term effectiveness. Alternatives S-2 and S-6 would provide the highest level of long-term effectiveness because all soil would be excavated, thereby leaving no residual risks exceeding 10^{-4} to 10^{-6}. Alternatives S-3 and S-4 would provide the next highest level of long-term effectiveness through excavation of all soil containing SVOCs, inorganics, and combined organics and inorganics at concentrations exceeding target cleanup levels. The magnitude of residual risks under Alternatives S-3 and S-4 would depend on the effectiveness of the SVE systems. The long-term effectiveness of Alternative S-8 would depend on the effectiveness of the asphalt cap.

Reduction of Toxicity, Mobility, and Volume: Alternative S-1 would not reduce toxicity, mobility, or volume of contaminated soil. Although Alternatives S-2 and S-8 would remove hazardous substances from Parcel B, they generally would not reduce the toxicity, mobility, or volume of contaminants because contaminated soil would be transported off site without treatment. However, Alternative S-8 would reduce contaminant mobility at two sites, IR-07 and IR-18, through the capping of these areas. Moreover, if contaminant concentrations in the excavated soil under any of the alternatives trigger RCRA land disposal restrictions, the soil would be treated to reduce its toxicity and/or mobility prior to land disposal. Alternatives S-3 and S-4 would use in situ SVE to reduce the toxicity and volume of VOCs. Alternative S-6 would rely on ex situ thermal desorption to reduce the toxicity, mobility, and volume of VOCs, SVOCs, and TPHs. Both Alternatives S-4 and S-6 would reduce the mobility of inorganics.

Short-Term Effectiveness: Other than Alternative S-1, all alternatives would involve significant excavation activities and therefore may generate dust emissions. The risk to the community is expected to be minimal from these dust generating activities. The potential threat to workers would be less under Alternatives S-3 and S-4 because instead of soil excavation, SVE systems would be installed. However, these alternatives may pose a threat to workers because of the handling of highly concentrated organic treatment residuals. All the alternatives would include dust and emission control measures and appropriate safety protocols to protect the community and workers during implementation.

Implementability: All of the alternatives would be technically implementable. Equipment for excavation, as well as the various treatment technologies considered (SVE, thermal desorption, asphalt encapsulation and stabilization), are readily available. In addition, landfill capacity is available for Alternatives S-2 and S-8, which involve significant off-site disposal. Alternatives S-2, S-6, and S-8 may be slightly more difficult to implement than Alternatives S-3 and S-4 because they require excavation under existing buildings. Alternatives S-3 through S-6 would require performance testing of the proposed treatment technologies. In terms of administrative feasibility, Alternative S-2 would be the easiest to implement; Alternatives S-3, S-4, and S-6 would all depend on the type and timeframe of remedial action at the IR-1/21 landfill. In addition, Alternatives S-3, S-4, and S-6 may require an assessment of risks from SVE system and thermal desorption system emissions.

Cost: The estimated costs of the alternatives range from approximately \$5,497,000 for Alternative S-8 to \$16,495,000 for Alternative S-6. Alternatives S-2, S-3, and S-4 are fairly comparable in cost, ranging from \$10,223,000 to \$12,905,000.

Groundwater Alternatives

Overall Protection of Human Health and the Environment: Alternative GW-1 would not be protective of human health and the environment. By imposing deed restrictions, Alternatives GW-2, GW-3, and GW-5 would prevent human exposure to contaminated groundwater. Alternatives GW-2, GW-3, and GW-5 would remove the DNAPL source, thereby preventing exposure because of inhalation of COPCs from A-aquifer groundwater. These alternatives would also protect the environment by removing preferential pathways for contaminated groundwater to discharge to San Francisco Bay. Alternatives G-3 and G-5 would provide additional short-term protection over Alternative GW-2 through extraction and treatment of groundwater at IR-25 and extraction or containment of groundwater at IR-07. Alternative GW-2 relies on natural attenuation and dilution rather than extraction.

Compliance with ARARs: No chemical-specific ARARs are identified for groundwater. Alternatives GW-2, GW-3, and GW-5 would meet their respective action- and location-specific ARARs.

Long-Term Effectiveness and Permanence: Alternative GW-1 would not be effective in the long-term because it would not reduce or eliminate risks from contaminated groundwater. The other alternatives would provide long-term protection through the use of deed restrictions and removal of the DNAPL source at IR-25 to minimize potential human health risks. Alternatives GW-2, GW-3, and GW-5 would also provide long-term protection to the environment by removing preferential pathways. Alternatives GW-3 and GW-5 would possible provide slightly greater long-term effectiveness because they would actively remove or contain contaminated groundwater; however, the long-term effectiveness of these alternatives depends on the efficiency of the extraction systems and the cap and slurry wall.

Reduction of Toxicity, Mobility, or Volume: Alternative GW-1 would not reduce the toxicity, mobility or volume of hazardous substances. The remaining alternatives would reduce the toxicity, mobility, and volume of DNAPLs at IR-25. Likewise, all the remaining alternatives would reduce the mobility of contaminants in groundwater by removing preferential pathways. Alternatives GW-3 and GW-5 would reduce the volume, toxicity, and mobility of contaminated groundwater by extraction and treatment; Alternative GW-5 would also reduce the mobility of contaminated groundwater by installing a slurry wall at IR-07.

Short-Term Effectiveness: Because no action would be taken under Alternative GW-1, it would pose no short-term risks to workers, the community, or the environment. Of the other three alternatives, Alternative GW-2 would provide the greatest short-term effectiveness. Under all the alternatives, the potential risks to the community and workers would minimal and related largely to possible fugitive dust or VOC emissions during DNAPL removal at IR-25. Alternatives GW-3 and GW-5 would pose a greater risk to the community than Alternative GW-2 because of the greater volume of soil that would be disturbed during extraction well and slurry wall installation. Malfunction of the extraction and treatment systems proposed under Alternatives GW-3 and GW-5 would also pose a potential risk to the community. Potential risks to workers are minimal and would be controlled through the use of appropriate safety protocols. Alternative GW-5 would present the greatest risk to workers because of the heavy construction required to install the slurry wall. Under Alternatives GW-2, GW-3, and GW-5, short-term risks to the environment would be minimal.

Implementability: Alternative GW-2 would be technically and administratively implementable. The only potential difficulty, which also applies to Alternatives GW-3 and GW-5 as well as GW-2, relates to the removal of DNAPLs underneath an existing building, especially if the extent of the DNAPLs is greater than currently anticipated. Alternatives GW-3 and GW-5 would be more difficult to implement than Alternative GW-2. In addition to the potential difficulties related to DNAPL removal, Alternatives GW-3 and GW-5 both require placing an extraction system and obtaining a permit from the POTW for discharge of contaminated groundwater. Because of potential difficulties associated with the construction of a slurry wall, Alternative GW-5 would be the most difficult alternative to implement.

Cost: Alternative GW-1, no action, involves no costs. The estimated capital and operation and maintenance (O&M) costs for the other three alternatives are as follows: $5,233,000 for Alternative GW-2; $7,500,000 for Alternative GW-3; and $7,183,000 for Alternative GW-5.

COMMUNITY PARTICIPATION ACTIVITIES

The proposed plan for Parcel B will be released to the public in October 1996. The RI report, the FS report, and the proposed plan will be made available to the public in the administrative record and in information repositories located at the City of San Francisco Main Library and the Anna E. Waden Branch Library. In addition, a fact sheet describing the proposed plan will be mailed to the more than 1,100 people on the HPS mailing list. A notice of availability of the proposed plan will be published in *The San Francisco Chronicle*, *The Independent*, and *The New Bayview*. A 30-day public comment period on the proposed plan is scheduled to begin in late October 1996. A public meeting will be held in early November 1996. At the meeting, Navy representatives will present the preferred alternatives and will be available to answer questions about the proposed plan. Comments received at the public meeting and during the public comment period will be included in the Responsiveness Summary, which will be included in the Record of Decision for Parcel B. These community participation activities fulfill the requirements of Section 113(k)(2)(B)(I-v) and Section 117(a)(2) of CERCLA.

TABLE ES-1
TYPES OF CONTAMINANTS PRESENT IN SOIL AND GROUNDWATER AT IR AND SI SITES
HUNTERS POINT SHIPYARD, PARCEL B FEASIBILITY STUDY

IR/SI SITE NO.	Contaminated Soil Volume (yd^3)	SOIL VOCs	SOIL SVOCs	SOIL Metals	SOIL TPHs	GROUNDWATER VOCs	GROUNDWATER SVOCs	GROUNDWATER Metals	GROUNDWATER TPHs
IR-06: Former Buildings 111 and 112; and Tank Farm	491		★	★	★	★	★	★	★
IR-07: Submarine Base Area	15,356		★	★	★	★		★	
IR-10: Building 123, Battery and Electroplating Shop	1,372	★	★	★	★	★	★	★	★
IR-18: Waste Disposal Area	17,488		★	★	★			★	★
IR-20: Building 156, Rubber Shop	438		★	★	★			★	★
IR-23: Building 146, Tactical Air Navigation (TACAN) Facility; Building 61, Maintenance Service; and Building 162, Paint Storage	141		★	★	★			★	★
IR-24: Building 124, Acid Mixing Plant; Building 125, Submarine Cafeteria; and Buildings 128 and 130, Machine Shop	876		★	★	★			★	★
IR-25: Building 134, Machine Shop, Quality and Reliability Assurance (Q&RA) Offices, and Central Tool Room	1,845	★	★	★	★	★	★	★	★
IR-26: Building 157, Nondestructive Testing Laboratory; and Area XIV	123		★	★	★			★	★
SI-31: Building 114, Offices	0								
IR-42 Building 109, Police Station; Building 113, Tug Maintenance Shop and Salvage Divers Shop; and Building 113A, Machine Shop, Torpedo Maintenance Shop, Tug Maintenance Shop, and Electrical Substation	144			★					
SI-45: Steam Line System	Not applicable[a]								
IR-46: Fuel Distribution Line and Tank Farm	Not applicable		★	★	★		★	★	★
IR-50: Storm Drain and Sanitary Sewer Systems	Not applicable			★				★	★
IR-51: Former Transformer Sites	Not applicable		★	★					
IR-60: Dry Docks 5, 6, and 7	164		★	★	★			★	★
IR-61: Building 122, Electrical Substation V and Compressor Plant	12		★	★	★			★	★
IR-62: Buildings 115 and 116, Submarine Training Buildings and School	0			★	★			★	★

Notes: a Not applicable indicates that soil was not sampled or that the IR site is a parcel-wide system and the volume of contaminated soil is accounted for in the contaminated soil volumes for other IR sites.

SVOC = Semivolatile organic compound
VOC = Volatile organic compound
TPH = Total petroleum hydrocarbons
yd^3 = Cubic yard

TABLE ES-2

SUMMARY OF REMOVAL ACTIONS
HUNTERS POINT SHIPYARD, PARCEL B

IR Site	Completed Removal Actions	Planned Removal Actions
IR-06: Former Buildings 111 and 112; and Tank Farm	One 12,000-gallon aboveground storage tanks (AST) containing lubrication oil; two 12,000-gallon ASTs containing Stoddard solvent; one 210,000-gallon AST containing diesel fuel; and seven 12,000-gallon ASTs containing diesel fuel were removed in 1993. Tanks, associated piping, asbestos-containing material, tank foundations, and pumphouses were removed and disposed of or salvaged off site. Eight ASTs containing a total of 3,000 gallons were removed.	The Navy plans to remove approximately 2,600 cubic yards of contaminated soil. Soil contaminated with hazardous substances, including lead, polychlorinated biphenyls (PCB), and polynuclear aromatic hydrocarbons (PAH), will be excavated and disposed of off site. Soil containing petroleum hydrocarbons will be bioremediated. The removal action is planned for late 1996.
IR-20: Building 156, Rubber Shop	Between 1991 and 1995, two tons of sandblast grit were removed, consolidated in Parcel E, and sent to an asphalt plant for recycling.	No additional removal actions are planned for IR-20.
IR-23: Building 146, Tactical Air Navigation (TACAN) Facility; Building 61, Maintenance Service; and Building 162, Paint Storage	One 750-gallon underground storage tank (UST) containing fuel oil and two ASTs of unknown capacity containing petroleum hydrocarbons were removed.	A total of 412 cubic yards (yd^3) of soil at three locations will be excavated and disposed of in off-site landfills during an exploratory excavation removal action planned for late 1996. The soil is contaminated with metals, petroleum hydrocarbons, pesticides, PCBs, PAHs, and volatile organic compounds.
IR-24: Building 124, Acid Mixing Plant; Building 125, Submarine Cafeteria; and Buildings 128 and 130, Machine Shop	Two 7,500-gallon ASTs containing sulfuric acid; two 5,000-gallon ASTs containing electrolytes; and one 5,000-gallon AST containing distilled water were removed.	No additional removal actions are planned for IR-24.
IR-26: Building 157, Nondestructive Testing Laboratory; and Area XIV	Between 1991 and 1995, twenty tons of sandblast grit were removed, consolidated in Parcel E, and sent to an asphalt plant for recycling.	A total of 429 yd^3 of soil at two locations will be excavated and disposed of in off-site landfills during an exploratory excavation removal action planned for late 1996. The soil is contaminated with metals, petroleum hydrocarbons, PCBs, and PAHs.
SI-31:Building 114, Offices	Between 1991 and 1995, thirty tons of sandblast grit were removed, consolidated in Parcel E, and sent to an asphalt plant for recycling.	No additional removal actions are planned for SI-31.
IR-62: Buildings 115 and 116, Submarine Training Buildings and School	One 1,250-gallon UST containing fuel oil and one 100-gallon AST containing unknown contents were removed.	No additional removal actions are planned for IR-62.

TABLE ES-3

CLEANUP GOAL SCENARIOS FOR SOIL

Soil Cleanup Goal Scenario	RAOs	
1	ELCR (future resident) $<10^{-6}$ HI (future child resident) < 1 Lead<221 mg/kg	TPH-d < 1,000 mg/kg TPH-g < 100 mg/kg TPH-mo < 1,000 mg/kg TRPH < 1,000 mg/kg
2	ELCR (future resident) $<10^{-5}$ HI (future child resident) < 1 Lead<221 mg/kg	TPH-d < 1,000 mg/kg TPH-g < 100 mg/kg TPH-mo < 1,000 mg/kg TRPH < 1,000 mg/kg
3	ELCR (future resident) $<10^{-4}$ HI (future child resident) < 1 Lead<221 mg/kg	TPH-d < 1,000 mg/kg TPH-g < 100 mg/kg TPH-mo < 1,000 mg/kg TRPH < 1,000 mg/kg
4	ELCR (future worker) $<10^{-6}$ HI (future child resident) < 1 Lead<1,000 mg/kg	TPH-d < 1,000 mg/kg TPH-g < 100 mg/kg TPH-mo < 1,000 mg/kg TRPH < 1,000 mg/kg
5	ELCR (future worker) $<10^{-5}$ HI (future child resident) < 1 Lead<1,000 mg/kg	TPH-d < 1,000 mg/kg TPH-g < 100 mg/kg TPH-mo < 1,000 mg/kg TRPH < 1,000 mg/kg
6	ELCR (future worker) $<10^{-4}$ HI (future child resident) < 1 Lead<1,000 mg/kg	TPH-d < 1,000 mg/kg TPH-g < 100 mg/kg TPH-mo < 1,000 mg/kg TRPH < 1,000 mg/kg

Notes:

ELCR	Excess lifetime cancer risk
HI	Hazard index
mg/kg	Milligram per kilogram
RAO	Remedial action objective
TPH-d	Total petroleum hydrocarbons as diesel fuel
TPH-g	Total petroleum hydrocarbons as gasoline
TPH-mo	Total petroleum hydrocarbons as motor oil
TRPH	Total recoverable petroleum hydrocarbons
<	Less than

TABLE ES-4

VOLUMES OF CONTAMINATED MEDIA AT PARCEL B
HUNTERS POINT SHIPYARD, PARCEL B FEASIBILITY STUDY

Contaminated Media Type	CLEANUP GOAL SCENARIO 1 (Residential ELCR $<10^{-6}$)	2 (Residential ELCR $<10^{-5}$)	3 (Residential ELCR $<10^{-4}$)	4 (Industrial ELCR $<10^{-6}$)	5 (Industrial ELCR $<10^{-5}$)	6 (Industrial ELCR $<10^{-4}$)
SOIL VOLUME (yd^3)						
Soil Containing Inorganics	24,381	24,364	20,810	12,543	6,779	3,420
Soil Containing SVOCs	2,915	2,830	2,714	2,647	2,579	575
Soil Containing VOCs	1,097	1,090	1,090	1,090	890	0
Soil Containing DNAPLs	500	500	500	500	500	500
Soil Containing Both Inorganics and Organics	9,557	9,550	3,649	8,675	2,757	60
GROUNDWATER VOLUME (gallons)						
Groundwater at IR-07	9,784,000	9,784,000	9,784,000	9,784,000	9,784,000	9,784,000
Groundwater at IR-25	1,556,000	1,556,000	1,556,000	1,556,000	1,556,000	1,556,000

Notes:

DNAPL	Dense nonaqueous-phase liquid
ELCR	Excess lifetime cancer risk
SVOCs	Semivolatile organic compounds
VOC	Volatile organic compound
yd^3	Cubic yard
<	Less than

TABLE ES-5

REMEDIAL ALTERNATIVES FOR CONTAMINATED SOIL

Alternative No.	Description
S-1	• No action
S-2	• Excavation and off-site incineration of DNAPL-contaminated soil • Excavation and off-site disposal of other soil in landfill
S-3	• Excavation and off-site incineration of DNAPL-contaminated soil • SVE • Excavation and on-site placement or off-site disposal of SVOC- and inorganic-contaminated soil in landfills
S-4	• Excavation and off-site incineration of DNAPL-contaminated soil • SVE • Excavation and off-site disposal of soil containing hazardous waste in landfill • Excavation, on-site asphalt encapsulation and stabilization of SVOC- and inorganic-contaminated soil, and on-site placement of stabilized soil
S-5	• Excavation and off-site incineration of DNAPL-contaminated soil • SVE • Excavation, CSPB of inorganic- and TPH-contaminated soil, S/S of CSPB-treated soil, and on-site placement • Excavation and S/S of inorganic- and SVOC-contaminated soil, and on-site placement
S-6	• Excavation, on-site thermal desorption of DNAPL-, VOC-, and SVOC-contaminated soil, and soil replacement • Excavation, on-site thermal desorption and S/S of inorganic- and organic-contaminated soil, and on-site placement • Excavation and S/S of soil containing combined inorganics and organics, and on-site placement
S-7	• Excavation, S/S, and on-site placement • Excavation and off-site incineration
S-8	• Excavation and incineration of DNAPL-contaminated soil • Asphalt cap at IR-07 and IR-18; and excavation of contaminated soil at IR sites other than IR-07 and IR-18 and off-site disposal in landfill

Notes:

DNAPL	Dense nonaqueous phase liquid
SVE	Soil
SVOC	Semivolatile organic compound
CSPB	Controlled slurry-phase bioremediation
TPH	Total petroleum hydrocarbon
S/S	Solidification/stabilization
VOC	Volatile organic compound

The alternatives listed above may also require deed restrictions based on the cleanup goal scenario selected.

TABLE ES-6

REMEDIAL ALTERNATIVES FOR CONTAMINATED GROUNDWATER

Alternative No.	Description
GW-1	• No action
GW-2	• Deed restrictions • Mitigative measures (DNAPL source removal at IR-25; lining of storm drains and pressure grouting of bedding material at IR-07, IR-10, and IR-25; removal and disposal of steam lines; removal and disposal of fuel lines and stained soil) • Groundwater monitoring
GW-3	• Deed restrictions • Mitigative measures (DNAPL source removal at IR-25; lining of storm drains and pressure grouting of bedding material at IR-07, IR-10, and IR-25; removal and disposal of steam lines; and removal and disposal of fuel lines and stained soil) • Groundwater monitoring • Groundwater extraction at IR-07 and IR-25 • On-site groundwater pretreatment • Discharge of pretreated groundwater to POTW
GW-4	• Deed restrictions • Mitigative measures (DNAPL source removal at IR-25; lining of storm drains and pressure grouting of bedding material at IR-07, IR-10, and IR-25; removal and disposal of steam lines; and removal and disposal of fuel lines and stained soil) • Groundwater monitoring • Groundwater extraction at IR-07 and IR-25 • On-site groundwater treatment • Discharge of treated groundwater to San Francisco Bay
GW-5	• Deed restrictions • Mitigative measures (DNAPL source removal at IR-25; lining of storm drains and pressure grouting of bedding material at IR-07, IR-10, and IR-25; removal and disposal of steam lines; and removal and disposal of fuel lines and stained soil) • Groundwater monitoring • Slurry wall containment with cap at IR-07 • Groundwater extraction at IR-25 • On-site groundwater pretreatment • Discharge of pretreated groundwater to POTW

Notes:

DNAPL = Dense nonaqueous phase liquid
POTW = Publicly-owned treatment works

TABLE ES-7

SCREENING CRITERIA FOR SOIL PLACEMENT AT IR-1/21 LANDFILL

COMPOUND	PLACEMENT CRITERIA (µg/L)
Metals	
Antimony	500
Arsenic	36
Barium	50,000
Beryllium	--
Cadmium	9.3
Chromium (III)	10,300
Chromium (VI)	50
Cobalt	--
Copper	28
Lead	14
Manganese	--
Mercury	0.60
Molybdenum	--
Nickel	96
Selenium	71
Silver	7.4
Thallium	2,130
Vanadium	--
Zinc	76
Organics	
Acenaphthene	710
Acenaphthylene	300
Anthracene	300
Benzo(a)anthracene	300
Benzene	5,100
Benzenes, chlorinated	129
Dichlorobenzenes	129
Trichlorobenzenes	129

TABLE ES-7 (Continued)

SCREENING CRITERIA FOR PLACEMENT AT IR-1/21

COMPOUND	PLACEMENT CRITERIA (µg/L)
Benzo(b)fluoranthene	300
Benzo(k)fluoranthene	300
Benzo(g,h,i)perylene	300
Benzo(a)pyrene	300
Bromochloromethane	--
Bromoform	6,400
Bromomethane	6,400
n-Butylbenzylphthalate	2,944
Carbon tetrachloride	6,400
Chlorobenzene	129
Chloroform	6,400
Chloromethane	6,400
2-Chloronaphthalene	7.5
4-Chlorophenol	29,700
Chrysene	300
DDT	0.001
Dieldrin	0.0019
DDD	3.6
DDE	14
Dibenz(a,h)anthracene	300
Dibromochloromethane	6,400
Dibutylphthalate	2,944
1,2-Dichlorobenzene	129
1,3-Dichlorobenzene	129
1,4-Dichlorobenzene	129
Dichlorodifluoromethane	6,400

TABLE ES-7 (Continued)

SCREENING CRITERIA FOR PLACEMENT AT IR-1/21

COMPOUND	PLACEMENT CRITERIA (μg/L)
1,2-Dichloroethane	113,000
1,1-Dichloroethylene	224,000
cis-1,2-Dichloroethylene	224,000
trans-1,2-Dichloroethylene	224,000
Dichloromethane	6,400
1,2-Dichloropropane	3,040
1,3-Dichloropropene	790
Di(2-ethylhexyl)adipate	--
Di(2-ethylhexyl)phthalate	360
Dimethylphthalate	2,944
4,6-Dinitro-o-cresol	4,850
Dinitrophenol	4,850
2,4-Dinitrophenol	4,850
2,4-Dinitrotoluene	590
2,6-Dinitrotoluene	590
Endosulfan	0.0087
Endosulfan sulfate	0.0087
Endrin	0.0023
Ethylbenzene	430
Ethylenes, dichloro-	224,000
Fluoranthene	40
Fluorene	300
Heptachlor	0.0036
Hexachlorocyclohexane-gamma	--
Hexachlorobenzene	129
Hexachlorobutadiene	32

TABLE ES-7 (Continued)

SCREENING CRITERIA FOR PLACEMENT AT IR-1/21

COMPOUND	PLACEMENT CRITERIA (μg/L)
Hexachlorocyclo-pentadiene	7
Hexachlorethane	940
Indeno(1,2,3-c,d)pyrene	300
Isophorone	12,900
Methanes, halo-	6,400
Naphthalene	2,350
Naphthalenes, chlorinated	7.5
Nitrobenzene	6,680
2-Nitrophenol	4,850
Nitrophenol	4,850
4-Nitrophenol	4,850
Nitrosamines	3,300,000
N-Nitrosodi-n-butylamine	3,300,000
N-Nitrosodiethylamine	3,300,000
N-Nitrosodimethylamine	3,300,000
N-Nitrosodiphenylamine	3,300,000
N-Nitrosodipropylamine	3,300,000
N-Nitrosomethylethyl-amine	3,300,000
N-Nitrosopyrrolidine	3,300,000
PAHs	15
Pentachlorophenol	7.9
Phenanthrene	4.6
Pentachlorobenzene	129
Pentachloroethane	281
Phenol	5,800
Phenols, nitro-	4,850

TABLE ES-7 (Continued)

SCREENING CRITERIA FOR PLACEMENT AT IR-1/21

COMPOUND	PLACEMENT CRITERIA (μg/L)
Phthalate esters	2,944
Polychlorinated biphenyls	0.03
Propanes, dichloro-	3,040
Propenes, dichloro-	790
Pyrene	300
1,2,4,5-Tetrachlorobenzene	129
1,1,2,2-Tetrachloroethane	9,020
Tetrachloroethylene (PCE)	450
2,3,5,6-Tetrachlorophenol	440
Toluene	5,000
Toxaphene	0.0002
1,2,4-Trichlorobenzene	129
1,1,1-Trichloroethane	31,200
Trichloroethylene (TCE)	2,000
Trichlorofluoromethane	6,400
Trinitrophenol	4,850
2,4,5-Trichlorophenol	11
Vinyl chloride	--
Xylenes	--

Notes:

PAH Polynuclear aromatic hydrocarbon
μg/L Microgram per liter
-- Not available

TABLE ES-8

SUMMARY OF DETAILED ANALYSES OF SOIL REMEDIAL ALTERNATIVES

Criterion	Alternative S-1	Alternative S-2	Alternative S-3	Alternative S-4	Alternative S-6	Alternative S-8
Overall Protection						
Human Health	Does not eliminate, reduce or control risks to human health	Reduces risks to human health by excavating all soil containing hazardous substances above cleanup standards	Reduces risks to human health by excavating soil containing SVOCs, inorganics, and combined inorganics and organics, and treating VOC-contaminated soil using SVE	Reduces risks to human health by excavating soil containing SVOCs, inorganics, and combined inorganics and organics, and treating VOC-contaminated soil using SVE	Reduces risk to human health by excavating all soil containing hazardous substances above cleanup standards	Reduces risks to human health by excavating some soil containing hazardous substances above cleanup standards, and prevents potential to exposure of contaminants
Environment	Does not eliminate, reduce, or control risks to the environment; hazardous substances would migrate to groundwater and eventually to San Francisco Bay	Reduces risks to the environment by removing hazardous substances through excavation, thereby eliminating potential for leaching of hazardous substances to groundwater	Reduces risks to the environment by removing hazardous substances through excavation or SVE treatment, thereby eliminating potential for leaching of hazardous substances to groundwater	Reduces risks to the environment by removing hazardous substances through excavation or SVE treatment, thereby eliminating potential for leaching of hazardous substances to groundwater	Reduces risks to the environment by removing hazardous substances through excavation, thereby eliminating potential for leaching of hazardous substances to groundwater	Reduces risk when used with a slurry wall by preventing infiltration of precipitation and further contamination of groundwater.
Compliance with ARARs						
Compliance with ARARs	Does not comply with chemical-specific or action-specific ARARs	Would comply with all chemical- or action-specific ARARs	Complies with all chemical- and action-specific ARARs	Complies with all chemical- and action-specific ARARs	Complies with all chemical- and action-specific ARARs	Complies with all chemical- and action-specific ARARs
Long-Term Effectiveness						
Magnitude of Residual Risks	Does not reduce or eliminate existing risks from soil containing hazardous substances	Leaves no residual risk following excavation of contaminated soil	No residual risks from exposure to SVOCs and inorganics after excavation; removes residual risks from exposure to VOCs through SVE treatment	No residual risks from exposure to SVOCs and inorganics after excavation; removes residual risks from exposure to VOCs through SVE treatment	No residual risks after excavation of contaminated soil	Residual risk remains below asphalt cap at IR-07 and IR-18; no residual risks at other IR sites

TABLE ES-8 (Continued)

SUMMARY OF DETAILED ANALYSES OF SOIL REMEDIAL ALTERNATIVES

Criterion	Alternative S-1	Alternative S-2	Alternative S-3	Alternative S-4	Alternative S-6	Alternative S-8
Adequacy and Reliability of Controls	Does not use controls to reduce risks to human or environmental receptors	Depends on controls taken at off-site, licensed landfill	Relies on adequate construction of cap at IR-1/21 landfill; untreated soil to be placed in landfill	Relies on adequate construction of cap at IR-1/21 landfill; soil treated through asphalt encapsulation and stabilization to be placed in landfill	Relies on adequate construction of cap at IR-1/21 landfill; soil treated by TD and S/S to be placed in landfill	Relies on adequate construction and maintenance of asphalt cap
Reduction of Toxicity, Mobility, or Volume						
Destruction of Toxic Hazardous Substances	Does not destroy toxic hazardous substances	Destroys DNAPL-contaminated soil only	Destroys VOCs removed during SVE off site treatment facility; destroys DNAPL-contaminated soil	Destroys VOCs removed during SVE off site treatment facility; destroys DNAPL-contaminated soil	Destroys VOCs, SVOCs, and TPHs removed during TD at off site treatment facility	Destroys DNAPL-contaminated soil only
Reduction of Total Mass of Toxic Hazardous Substances	Does not reduce total mass of toxic hazardous substances	Does not reduce total mass of toxic hazardous substances	Reduces total mass of VOCs by destroying VOCs removed during SVE off site	Reduces total mass of VOCs by destroying VOCs removed during SVE off site	Reduces total mass of VOCs, SVOCs, and TPHs by destroying condensate from TD system off site	Reduces total mass of VOCs, SVOCs, and TPHs by destroying DNAPLs
Irreversible Reduction in Hazardous Substance Mobility	Does not reduce hazardous substance mobility	Does not reduce hazardous substance mobility	Reduces hazardous substance mobility by removing VOCs from soil	Reduces mobility of VOCs, SVOCs, and TPHs by destroying condensate from TD system off site substance mobility by stabilizing inorganics and encapsulating organics	Reduces hazardous substance mobility by removing VOCs from soil and stabilizing inorganics	Reduces mobility of contaminants by reducing infiltration of precipitation
Reduction of the Total Volume of Contaminated Media	Does not reduce total volume of contaminated media	Does not reduce total volume of contaminated media	Reduces total volume of soil containing VOCs; does not reduce total volume of soil containing SVOCs or inorganics	Reduces total volume of soil containing VOCs; increases total volume of soil containing SVOCs and inorganics from volume increase during asphalt encapsulation and stabilization	Reduces total volume of soil containing VOCs, SVOCs, and TPHs; increases total volume of soil containing inorganics from volume increase during S/S	Minimally reduces the total volume of contaminated soil through off-site disposal

TABLE ES-8 (Continued)

SUMMARY OF DETAILED ANALYSES OF SOIL REMEDIAL ALTERNATIVES

Criterion	Alternative S-1	Alternative S-2	Alternative S-3	Alternative S-4	Alternative S-6	Alternative S-8
Short-term Effectiveness						
Protection of the Community	Does not pose health risks to community	Poses minimal risk to community from contaminated dust during excavation and VOCs during treatment	Poses minimal risk to community from contaminated dust during excavation and VOCs during SVE treatment	Poses minimal risk to community from contaminated dust during excavation and asphalt encapsulation and stabilization treatment and VOCs during SVE treatment	Poses minimal risk to community from contaminated dust during excavation and S/S treatment and VOCs, SVOCs, and TPHs during TD treatment	Poses minimal risk to community from contaminated dust during excavation and asphalt cap placement
Protection of Workers	Does not pose any health risks to response workers	Poses occupational risks from heavy excavation equipment and chemical hazards from dust and VOC inhalation during excavation	Poses occupational risks from heavy equipment used during excavation and chemical hazards from dust inhalation and VOCs during excavation and installation of SVE system	Poses occupational risks from heavy equipment used during excavation and asphalt encapsulation and stabilization treatment and chemical hazards from dust during inhalation and VOC during excavation and installation of SVE system	Poses occupational risks from heavy equipment used during excavation and TD and S/S treatment and chemical hazards from dust and VOC, SVOC and TPH inhalation during excavation and S/S and TD treatment	Poses occupational risks from asphalt paving; much less occupational risk from excavation than other alternatives
Environmental Impacts	Does not produce adverse environmental impacts during implementation	Poses minimal potential for environmental impact; relies on engineered controls to reduce dust emissions that may migrate to San Francisco Bay	Poses minimal potential for environmental impact; relies on engineered controls to reduce dust emissions that may migrate to San Francisco Bay	Poses minimal potential for environmental impact; relies on engineered controls to reduce dust emissions that may migrate to San Francisco Bay	Poses minimal potential for environmental impact; relies on engineered controls to reduce dust emissions that may migrate to San Francisco Bay	Poses minimal potential for environmental impact; less potential for dust emissions from IR-07 and IR-18
Time Required for Remedial Action	None	3 to 6 months	3 to 6 months	5 to 8 months	6 to 12 months	3 to 6 months

TABLE ES-8 (Continued)

SUMMARY OF DETAILED ANALYSES OF SOIL REMEDIAL ALTERNATIVES

Criterion	Alternative S-1	Alternative S-2	Alternative S-3	Alternative S-4	Alternative S-6	Alternative S-8
Implementability						
Technical Feasibility	Requires no construction or operation	Technically easy to implement because excavation depth relatively shallow and adequate landfill capacity available but excavation below buildings may cause problems	Technically easy to implement; requires coordination with remedial action at the IR-1/21 landfill	Technically easy to implement; feasibility of asphalt encapsulation and stabilization system will be evaluated during removal action at Parcel B; requires coordination with remedial action at the IR-1/21 landfill	Technically easy to implement; requires significant mobilization of TD and S/S treatment equipment; treatment systems have demonstrated effectiveness at other CERCLA sites; requires coordination with remedial action at the IR-1/21 landfill	Technically very easy to implement; common construction techniques can be applied; less excavation requirements
Administrative Feasibility	Not administratively acceptable	Administratively easy to implement because requires little interaction and coordination with regulatory agencies	Requires coordination with RWQCB to ensure that soil placement at IR-1/21 landfill is protective of environment; requires performance testing of SVE system	Requires coordination with RWQCB to ensure that soil placement at IR-1/21 landfill is protective of environment; requires performance testing of SVE and asphalt encapsulation and stabilization systems	Requires coordination with RWQCB to ensure soil placement at IR-1/21 landfill is protective of environment; requires performance testing of SVE, TD, and S/S systems	Difficult administratively because of long-term maintenance of cap and deed restrictions required following construction of the cap
Cost						
Cost	None	\$2,980,000 to \$12,900,000	\$2,990,000 to \$10,200,000	\$2,990,000 to \$11,500,000	\$4,180,000 to \$16,500,000	\$3,380,000 to \$5,500,000

TABLE ES-9

SUMMARY OF INDIVIDUAL DETAILED ANALYSES OF GROUNDWATER REMEDIAL ALTERNATIVES

Criterion	Alternative GW-1	Alternative GW-2	Alternative GW-3	Alternative GW-5
Overall Protection				
Human Health	Does not eliminate, reduce or control risks to human health; VOCs would continue to permeate through cracks in foundation and walls of Building 134	Reduces risks to human health by implementing mitigative measures, removing and destroying DNAPLs, placing deed restrictions on groundwater, and monitoring groundwater	Reduces risks to human health by extracting contaminated groundwater, pretreating it, and further treating it at a POTW; removing DNAPLs; and placing deed restrictions on groundwater	Reduces risks to human health by containing the off-site migration of contaminated groundwater with a slurry wall , groundwater extraction, and on-site treatment, removal of DNAPLs, and placement of deed restrictions on groundwater
Environment	Does not eliminate, reduce, or control risks to the environment because groundwater containing organic and inorganic hazardous substances would continue to migrate toward San Francisco Bay	Reduces risks to the environment by implementing mitigation measures, removing and destroying DNAPLs, and monitoring groundwater	Reduces risks to the environment by removing and destroying DNAPLs, implementing mitigative measures, extracting and treating groundwater, and monitoring groundwater	Reduces risks to the environment by extracting and treating groundwater, removing and destroying DNAPLs, implementing mitigative measures, and monitoring groundwater
Compliance with ARAR				
Compliance with chemical-, location-, and action-specific ARARs	Does not comply with chemical- or action-specific ARARs	Complies with federal and state ARARs	Complies with federal and state ARARs	Complies with federal and state ARARs
Long-Term Effectiveness				
Magnitude of Residual Risks	Does not reduce or eliminate existing risks from groundwater containing hazardous substances	Reduces residual risks through off-site disposal of DNAPLs and TPHs; removal of groundwater pathway to the bay through storm drains and bedding material; and removal of steam and fuel lines and stained soil; residual risks associated with hazardous substances in groundwater may decrease partially due to natural dilution and attenuation	Eliminates residual risks from groundwater containing hazardous substances through DNAPL and TPH removal and destruction; groundwater extraction, treatment, and off-site discharge; and implementing mitigative measures	Reduces residual risks further than Alternative GW-2 through containment, removal, and treatment of contaminated groundwater and off-site treatment of DNAPLs and TPHs

SUMMARY OF INDIVIDUAL DETAILED ANALYSES OF GROUNDWATER REMEDIAL ALTERNATIVES

Criterion	Alternative GW-1	Alternative GW-2	Alternative GW-3	Alternative GW-5
Adequacy and Reliability of Controls	Does not use controls to reduce risks to human and environmental receptors	Relies on deed restrictions to prevent human exposure to contaminated groundwater and on mitigative measures to protect ecological receptors in the bay; relies on engineering controls to reduce direct contact with or ingestion of groundwater by remedial workers, and to reduce potential exposure of workers	Relies on the same components as those in Alternative GW-2, as well as contaminated groundwater extraction, pretreatment, and discharge to POTW; and periodic maintenance and monitoring	Relies on the same components as those in Alternative GW-2, as well as extraction wells, pretreatment, and discharge to POTW; adequate design and construction of a slurry wall to contain contaminated groundwater; and periodic maintenance and monitoring
Reduction of Toxicity, Mobility, or Volume				
Destruction of Toxic Hazardous Substances	Does not destroy toxic hazardous substances	Destroys DNAPLs and TPHs removed from groundwater through off-site treatment; treats excavated DNAPLs associated with soil using selected soil alternative	Reduces and destroys toxic hazardous substances through groundwater extraction, pretreatment, and further off-site treatment at a POTW; destroys DNAPLs through extraction and transport to an off-site commercial treatment facility	Reduces hazardous substances in extracted groundwater through on-site pretreatment and destroys toxic hazardous substances associated with DNAPLs
Reduction of Total Mass of Toxic Hazardous Substances	Does not reduce total mass of toxic hazardous substance	Reduces total mass of toxic hazardous substances through treatment of DNAPLs and TPHs, and treatment of DNAPLs in soil using selected soil alternative	Reduces the total mass of toxic hazardous substances through extraction, pretreatment, and further treatment at POTW; removes DNAPLs for treatment to reduce mass of hazardous substances associated with DNAPLs	Reduces mass of organic hazardous substances associated with DNAPLs through excavation and treatment; reduces mass of hazardous substances through extraction, pretreatment, and discharge to POTW; does not reduce mass of contaminated groundwater through slurry wall containment
Irreversible Reduction in Hazardous Substance Mobility	Does not reduce hazardous substance mobility	Reduces mobility of hazardous substances in groundwater through mitigative measures; in addition, DNAPLs are removed during excavation thereby eliminating their mobility	Reduces mobility of hazardous substances by extracting groundwater containing hazardous substances and treating groundwater to permanently remove organics and inorganics; in addition, DNAPLs extracted, thereby eliminating their mobility	Reduces mobility of hazardous substances by containing groundwater containing hazardous substances; in addition, DNAPLs extracted, thereby eliminating their mobility

TABLE ES-9 (Continued)

SUMMARY OF INDIVIDUAL DETAILED ANALYSES OF GROUNDWATER REMEDIAL ALTERNATIVES

Criterion	Alternative GW-1	Alternative GW-2	Alternative GW-3	Alternative GW-5
Reduction of the Total Volume of Contaminated Media	Does not reduce total volume of contaminated media	May reduce volume of groundwater containing hazardous substances through natural dilution and attenuation; reduces volume of DNAPL contaminated groundwater through removal and treatment	Reduces volume of contaminated groundwater through extraction, pretreatment, and discharge to POTW for further treatment; groundwater containing DNAPLs and TPHs reduced through extraction and off-site commercial treatment	Reduces volume of contaminated groundwater through extraction, pretreatment, and discharge to a POTW, groundwater containing DNAPLs and TPHs reduced through extraction and off-site commercial treatment; slurry wall containment does not reduce volume of contaminated media
Short-Term Effectiveness				
Protection of the Community	Does not pose health risks to the community	May pose minimal risks to community from fugitive dust emissions during mitigative measures	May pose minimal risks to community during mitigative measures implementation, and extraction well and pretreatment system installation from release of fugitive dust emissions	May pose minimal risks to community from exposure to fugitive dust emissions during mitigative measures implementation and well installation and construction of the pretreatment system
Protection of Workers	Does not pose any health risks to workers	May pose risks to workers through direct contact with and inhalation of hazardous substances; during DNAPL source removal, proper personal protection equipment (PPE) should minimize risks to workers	May pose risks to workers through direct contact with and inhalation of hazardous substances; during DNAPL source removal, proper PPE and air monitoring should minimize risks to workers; poses additional physical risk during construction	May pose risks to workers through direct contact with and inhalation of hazardous substances; during DNAPL source removal, proper PPE and air monitoring should minimize risks to workers; poses additional physical risks during construction
Environmental Impacts	Does not result in adverse environmental impacts	Does not result in adverse environmental impacts	Does not result in adverse environmental impacts	Does not result in adverse environmental impacts
Time Required for Remedial Action	None	Approximately 30 years (groundwater monitoring)	IR-25: 3 years IR-07: Indefinite	IR-25: 3 years IR-07: Indefinite

TABLE ES-9 (Continued)

SUMMARY OF INDIVIDUAL DETAILED ANALYSES OF GROUNDWATER REMEDIAL ALTERNATIVES

Criterion	Alternative GW-1	Alternative GW-2	Alternative GW-3	Alternative GW-5
Implementability				
Technical Feasibility	No construction or operation required	Technically feasible to implement; pressure grouting of bedding material and drain lining and removal of storm and fuel lines are moderately difficult to implement; removal of DNAPLs underneath an existing building is potentially difficult to implement	Technically feasible but more difficult than Alternative GW-2 to implement; properly designed, constructed, and maintained extraction wells and pretreatment systems are proven and effective methods; pump tests and treatability studies required before design of extraction well and pretreatment system	Technically feasible to implement; methods to design and construct slurry walls well established and readily available; removal or temporary relocation of railroad tracks, storm and sanitary sewers, fuel distribution lines, and steam lines may be required during slurry wall construction; properly designed, constructed, and maintained extraction wells and pretreatment systems are proven and effective methods; pump tests and treatability studies required before design of extraction well and pretreatment system
Administrative Feasibility	No deed notifications, permits, or groundwater monitoring required	Requires placing deed restrictions on groundwater and indefinite monitoring	In addition to deed restrictions and indefinite groundwater monitoring, a discharge permit is needed from the POTW.	In addition to deed restrictions and indefinite groundwater monitoring, a discharge permit is needed from the POTW.
Cost				
Capital Cost	$0	$3,154,000	$3,570,000	$5,003,000
Present Worth of Annual O&M Cost	0	2,079,000	3,930,000	2,180,000
Total	$0	$5,233,000	$7,500,000	$7,183,000

TABLE ES-10

COMPARISON OF SOIL REMEDIAL ALTERNATIVES

EVALUATION CRITERIA	SOIL ALTERNATIVE		
	S-1 No Action	S-2 Excavation DNAPL Incineration Off-Site Disposal	S-3 SVE Excavation DNAPL Incineration Off-Site Disposal On-Site Placement
Threshold Criteria			
Overall Protection of Human Health and the Environment	No	Yes	Yes
Compliance with ARARs	No	Yes	Yes
Balancing Criteria			
Long-Term Effectiveness	-	+	0
Reduction of Toxicity, Mobility, or Volume	-	+	0
Short-Term Effectiveness	+	0	0
Implementability	-	+	0
Cost	+	0	0
Overall Rating	-	+	0

TABLE ES-10 (Continued)

COMPARISON OF SOIL REMEDIAL ALTERNATIVES

EVALUATION CRITERIA	SOIL ALTERNATIVE		
	S-4 SVE Excavation DNAPL Incineration Asphalt Stabilization On-Site Placement	S-6 Excavation Thermal Desorption Solidification/Stabilizat ion On-Site Placement	S-8 Asphalt Cap Excavation DNAPL Incineration Off-Site Disposal On-Site Placement
Threshold Criteria			
Overall Protection of Human Health and the Environment	Yes	Yes	Yes
Compliance with ARARs	Yes	Yes	Yes
Balancing Criteria			
Long-Term Effectiveness-	0	+	0
Reduction of Toxicity, Mobility, or Volume	0	+	-
Short Term Effectiveness	0	0	+
Implementability	0	0	+
Cost	0	-	+
Overall Rating	0	+	0

Notes:
+ = Meets an evaluation criterion more completely
0 = Meets an evaluation criterion
- = Meets an evaluation criterion less completely

TABLE ES-11

COMPARISON OF GROUNDWATER REMEDIAL ALTERNATIVES

EVALUATION CRITERIA	GROUNDWATER ALTERNATIVES			
	GW-1 No Action	GW-2 Access Restrictions Mitigative Measures Monitoring	GW-3 Access Restrictions Mitigative Measures Extraction at IR-07 + IR-25 Pretreatment Discharge to POTW Monitoring	GW-5 Access Restrictions Mitigative Measures Extraction at IR-25 Slurry Wall and Cap at IR-07 Pretreatment Discharge to POTW
Threshold Criteria				
Overall Protection of Human Health and the Environment	No	Yes	Yes	Yes
Compliance with ARARs	No	Yes	Yes	Yes
Balancing Criteria				
Long-Term Effectiveness	-	0	+	+
Reduction of Toxicity, Mobility, or Volume	-	0	+	+
Short Term Effectiveness	+	+	0	-
Implementability	+	+	0	-
Cost	+	+	-	-
Overall Rating	-	+	0	-

Notes:

+	=	Meets an evaluation criterion most completely
0	=	Meets an evaluation criterion
-	=	Meets an evaluation criterion less completely

EXPLANATION

- PARCEL B BOUNDARY
- EXTENDED SITE BOUNDARY
- RME CARCINOGENIC RISK IS EQUAL TO OR EXCEEDS 1.0E-2
- RME CARCINOGENIC RISK IS 1.0E-3 TO LESS THAN 1.0E-2
- RME CARCINOGENIC RISK IS 1.0E-4 TO LESS THAN 1.0E-3
- RME CARCINOGENIC RISK IS 1.0E-5 TO LESS THAN 1.0E-4
- RME CARCINOGENIC RISK IS 1.0E-6 TO LESS THAN 1.0E-5
- RME CARCINOGENIC RISK IS LESS THAN 1.0E-6
- COPCs WERE SAMPLED AND CARCINOGENIC COPCs WERE NOT IDENTIFIED IN THIS EXPOSURE AREA
- SAMPLES WERE NOT COLLECTED IN THIS EXPOSURE AREA

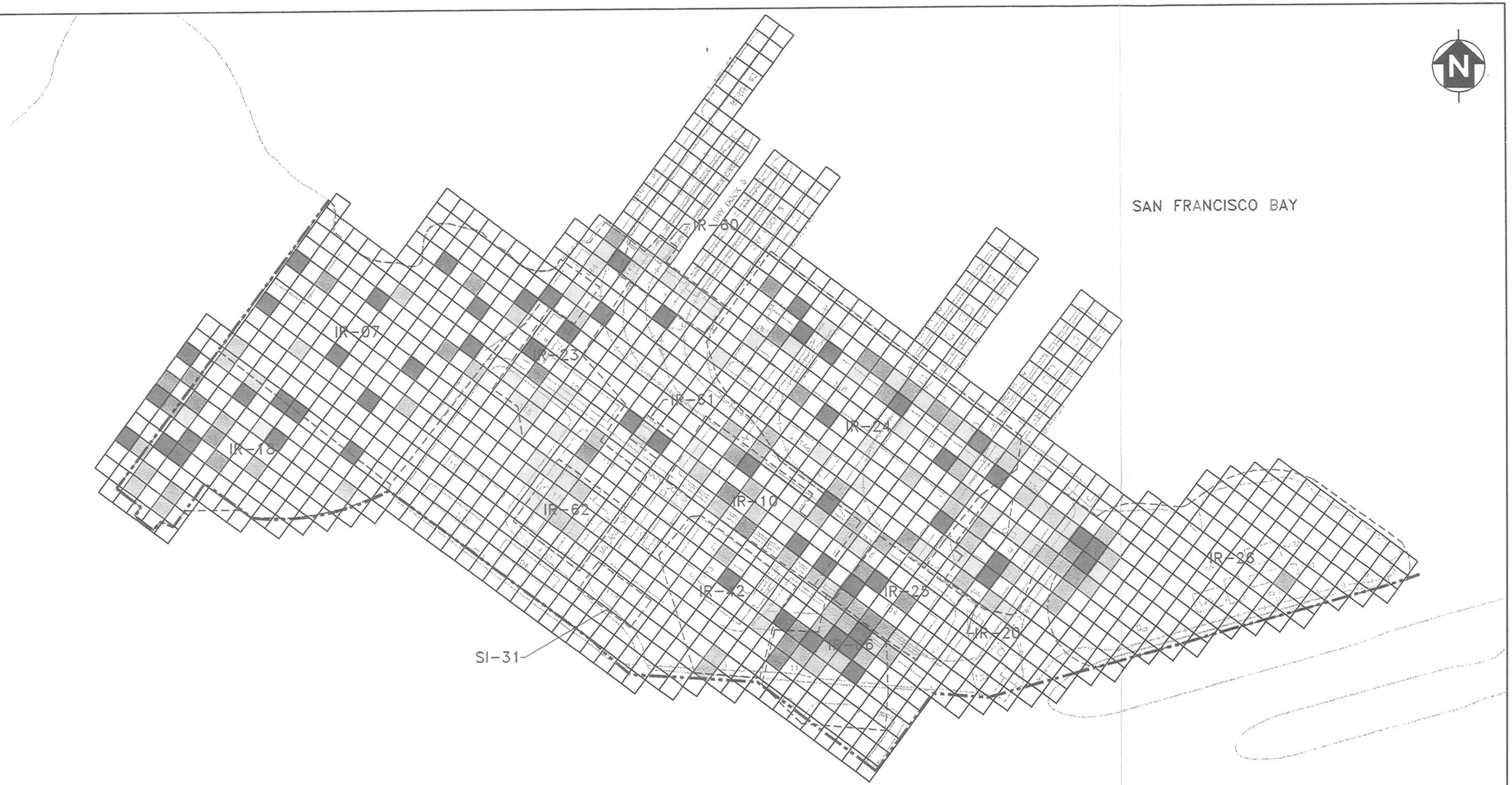
DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

FIGURE ES-1
PARCEL B
CARCINOGENIC RISK FROM
COPCs IN SOIL 0 TO 10 FEET BGS
FUTURE INDUSTRIAL SCENARIO



EXPLANATION

- PARCEL B BOUNDARY
- EXTENDED SITE BOUNDARY
- RME CARCINOGENIC RISK IS EQUAL TO OR EXCEEDS 1.0E-2
- RME CARCINOGENIC RISK IS 1.0E-3 TO LESS THAN 1.0E-2
- RME CARCINOGENIC RISK IS 1.0E-4 TO LESS THAN 1.0E-3
- RME CARCINOGENIC RISK IS 1.0E-5 TO LESS THAN 1.0E-4
- RME CARCINOGENIC RISK IS 1.0E-6 TO LESS THAN 1.0E-5
- RME CARCINOGENIC RISK IS LESS THAN 1.0E-6
- COPCs WERE SAMPLED AND CARCINOGENIC COPCs WERE NOT IDENTIFIED IN THIS EXPOSURE AREA
- SAMPLES WERE NOT COLLECTED IN THIS EXPOSURE AREA

150 0 150 300
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

FIGURE ES-2
PARCEL B
CARCINOGENIC RISK FROM
COPCs IN SOIL 0 TO 10 FEET BGS
FUTURE CHILD AND ADULT RESIDENTIAL SCENARIO

IR-07

IR07B003 - B0129

DEPTH	COPC	CONC
1.75 TO 6.25	BERYLLIUM	0.74 TO 1.0
6.25	COPPER	258
3.75 AND 6.25	LEAD	379 AND 383
6.25	ZINC	690
1.75	4,4'-DDE	540
1.75	4,4'-DDT	540
3.75	BENZO(B)FLUORANTHENE	82
6.25	BENZO(A)PYRENE	79
6.25	BENZO(B)FLUORANTHENE	80

IR07B039 - B0132

DEPTH	COPC	CONC
6.25	LEAD	1,190
3.75	BENZO(A)ANTHRACENE	210
3.75 AND 6.25	BENZO(A)PYRENE	240 AND 45
3.75 AND 6.25	BENZO(B)FLUORANTHENE	230 AND 59
6.25	BENZO(K)FLUORANTHENE	34

IR07B005 - B0379

DEPTH	COPC	CONC
3.75 AND 6.25	ARSENIC	20.7 AND 20.9
6.25	LEAD	885
1.75	BENZO(A)PYRENE	130
1.75	BENZO(B)FLUORANTHENE	200

IR07B011 - B1024

DEPTH	COPC	CONC
1.75 TO 6.25	BERYLLIUM	0.66 TO 1.1
3.75	COPPER	243
1.75 AND 3.75	AROCLOR-1260	340 AND 180
1.75 TO 6.25	BENZO(A)PYRENE	68 TO 99
1.75 TO 6.25	BENZO(B)FLUORANTHENE	97 TO 140
1.75 TO 6.25	BENZO(K)FLUORANTHENE	46 TO 82
1.75	INDENO(1,2,3-CD)PYRENE	44

IR07B044 - B0933

DEPTH	COPC	CONC
3.75	AROCLOR-1254	140

IR07B032 - B1030

DEPTH	COPC	CONC
3.75	ANTIMONY	44.1
1.75 TO 6.25	BERYLLIUM	0.80 TO 1.1
3.75	ALDRIN	14
3.75	BENZO(A)ANTHRACENE	190
3.75	CHRYSENE	400

IR61

IR61B009 - B2225

DEPTH	COPC	CONC
0.50 AND 2.75	AROCLOR-1260	250 AND 110

IR61B007 - B2425

DEPTH	COPC	CONC
1.25	ARSENIC	15.6

IR-62

IR62B001 - B2330

DEPTH	COPC	CONC
9.25	BIS(2-ETHYLHEXYL)PHTHALATE	3,000

IR60

IR60MW04A - B1818

DEPTH	COPC	CONC
9.75	ZINC	485

IR60MW03A - B2019

DEPTH	COPC	CONC
5.25	ARSENIC	21.1
8.25	ZINC	376

RME CARCINOGENIC RISK IS EQUAL TO OR EXCEEDS 1.0E-2
RME CARCINOGENIC RISK IS 1.0E-3 TO LESS THAN 1.0E-2
RME CARCINOGENIC RISK IS 1.0E-4 TO LESS THAN 1.0E-3
RME CARCINOGENIC RISK IS 1.0E-5 TO LESS THAN 1.0E-4
RME CARCINOGENIC RISK IS 1.0E-6 TO LESS THAN 1.0E-5
RME CARCINOGENIC RISK IS LESS THAN 1.0E-6
COPCs WERE SAMPLED AND CARCINOGENIC COPCs WERE NOT IDENTIFIED IN THIS EXPOSURE AREA
SAMPLES WERE NOT COLLECTED IN THIS EXPOSURE AREA
* AVERAGE CARCINOGENIC RISK IS EQUAL TO OR EXCEEDS 1.0E-6

EXPLANATION

SURFACE SOIL SAMPLE LOCATION
BORING SAMPLE LOCATION
MONITORING WELL LOCATION A-AQUIFER
MONITORING WELL LOCATION BEDROCK WATER-BEARING ZONE
TRENCH AREA SAMPLE LOCATION

PROPOSED EXPLORATORY EXCAVATION SITE
6-2 REMEDIATION AREA BOUNDARY
DE MINIMUS AREA LOCATION

PARCEL B BOUNDARY
EXTENDED SITE BOUNDARY
2,500 SQUARE FEET EXPOSURE AREA BOUNDARY

DEPTH IN FEET
COPC = CHEMICAL OF POTENTIAL CONCERN
CONC = CONCENTRATION (INORGANICS=mg/kg, ORGANICS=μg/kg)
SVOC = SEMIVOLATILE ORGANIC COMPOUNDS
VOC = VOLATILE ORGANIC COMPOUNDS

SCALE 1" = 100'

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST
SAN BRUNO, CALIFORNIA

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

FIGURE ES-3
SOIL CLEANUP AREAS AT PARCEL B

1.0 INTRODUCTION

PRC Environmental Management, Inc. (PRC), received Contract Task Order (CTO) No. 011 under Comprehensive Long-term Environmental Action Navy (CLEAN) II Contract No. N62474-94-D-7609 from the U.S. Department of the Navy (Navy), Engineering Field Activity West, Naval Facilities Engineering Command (EFA WEST), to conduct a remedial investigation (RI) and feasibility study (FS) at Parcels B and C of Hunters Point Shipyard (HPS) located in San Francisco, California. As the lead agency, the Navy has authority over the selection of the remedial alternative, the risk evaluation, and overall public participation activities at HPS. The Navy is working in cooperation with the U.S. Environmental Protection Agency (U.S. EPA) Region IX, the California Department of Toxic Substances Control (DTSC) Region 2, and the California Regional Water Quality Control Board - San Francisco Bay Region (RWQCB) to develop and implement the selected remedial alternative.

To expedite the transfer of the HPS facility to the City and County of San Francisco for development, the Navy divided the facility into six parcels, A through F. The RI for Parcel B was conducted from 1988 to 1996. A draft-final RI report was prepared and submitted to U.S. EPA Region IX on June 3, 1996. This FS was conducted concurrently with the RI to identify and screen technologies and evaluate alternatives for remediating Parcel B. The purpose and organization of this FS is discussed below in Section 1.1. Section 1.2 describes the parcel designation strategy for the HPS facility and its impact on this FS.

1.1 PURPOSE AND ORGANIZATION OF REPORT

The purpose of this FS report is to identify, screen, and evaluate remedial alternatives for Parcel B at HPS. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) states that the evaluation of remedial alternatives shall include an assessment of permanent solutions and alternative treatment technologies that, in whole or in part, will result in a permanent and significant decrease in the toxicity, mobility, or volume of the hazardous substance, pollutant, or contaminant. Furthermore, the NCP specifies that a remedial action shall be selected that is protective of human health and the environment, that is cost effective, and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. To prepare this report, PRC followed the "Draft Guidance for Conducting Remedial Investigations and Feasibility Studies" under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (U.S. EPA 1988) and the NCP.

In the FS process, remedial alternatives are developed by assembling media-specific technologies into cleanup alternatives. The process consists of following general steps:

- Develop remedial action objectives (RAO) specifying the contaminants and media of interest, exposure pathways, and remediation goals that permit a range of treatment and containment alternatives to be developed. The RAOs are developed on the basis of chemical-specific applicable or relevant and appropriate requirements (ARAR) and human health and ecological risk assessments.

- Develop general response actions (GRA) for each medium defining containment, removal, treatment, disposal, or other actions, singly or in combination, that may be taken to satisfy the RAOs for the site.

- Identify volumes or areas to which GRAs would apply.

- Identify and screen remedial technologies for each GRA to eliminate those that cannot be implemented technically at the site. The GRAs are further defined to specify remedial technology types. For example, the GRA of treatment can be further defined to include chemical or biological technology types.

- Identify and screen process options for each remedial technology to select a representative process for remediation. Although specific processes are selected for alternative development and evaluation, these processes are intended to represent the broader range of process options within a general technology type. For example, chemical oxidation and dechlorination are chemical treatment process options.

- Assemble process options into a range of alternatives, screen the alternatives, and evaluate the retained alternatives.

This report has six sections including this introduction. Section 2.0 provides site characterization information for HPS and Parcel B, including (1) the history of HPS; (2) the facility setting of HPS; (3) site characteristics for each of the 18 installation restoration (IR) and site investigation (SI) sites investigated during the Parcel B RI; (4) removal actions at Parcel B; (5) a risk assessment summary; and (6) potential RI data gaps, planned additional investigations, and mitigative measures. Section 3.0 presents the RAOs and the estimated volume of materials to be remediated and identifies and screens GRAs and appropriate technology process options. In Section 4.0, alternatives are developed and screened from the process options that were retained after process option screening. Section 5.0 analyzes each of the retained alternatives in detail and compares the alternatives. Section 6.0 provides a list of references used in this report.

1.2 PARCEL DESIGNATION STRATEGY

Prior to April 1992, the potentially contaminated sites at HPS were grouped into five operable units. The operable units were based on a preliminary evaluation of the potential threat to human health and the environment, location of the sites, and similarities in investigation or remediation strategy and chemical conditions. In April 1992, the Navy redefined the environmental investigation and cleanup program for HPS by creating geographic parcels. To help accelerate transfer of the facility, the land portion of HPS, which encompasses about 493 acres, was divided into five parcels, Parcels A through E (see Figure 1-1). To address regulatory agency concerns about possible contamination of the bay, the offshore portion of HPS, which encompasses about 443 acres, was later included in the IRP as Parcel F. The RI for Parcel A has been approved by the U.S. EPA and DTSC and a record of decision has been signed. RI/FS work is ongoing at Parcels B through F.

Parcel B consists of about 66 acres of northeast shoreline and lowland coast. Parcel B comprises 18 Installation Restoration Program (IRP) sites investigated for chemical contamination, radioactivity, and underground storage tanks (UST): SI-31; part of SI-45; IR-06, IR-07, IR-10, IR-18, IR-20, IR-23, IR-24, IR-25, IR-26, IR-42, IR-46, IR-60, IR-61, and IR-62; and part of IR-50 and IR-51.

The parcel approach for the RI/FS process impacts this FS in two ways. First, potential economies of scale will be considered qualitatively when screening GRAs, technologies, and process options. It is possible that some GRAs, technologies, and process options may not be cost-effective for managing the volume of contaminated media at Parcel B, but may become cost-effective when the quantity of contaminated material in other parcels are considered. Second, to expedite removal of contaminated media from Parcel B and transfer Parcel B lands to the City and County of San Francisco, this FS will also assess the management of contaminated nonhazardous soil in interim storage units at the HPS facility before treatment or disposal. Only soil containing contaminants with a low potential for leaching and volatilization will be managed in the interim storage units. Management of contaminated materials in an interim storage unit will allow for remedial alternatives developed for Parcel B to be implemented at a later date to remediate contaminated media from multiple parcels, thus reducing mobilization, demobilization, and administrative costs.

Legend

IR SITE	EXISTING BUILDING
SI SITE	FORMER BUILDING
UST SITE	PARCEL BOUNDARY
	FACILITY BOUNDARY

450 0 450 900
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
ENGINEERING FIELD ACTIVITY WEST
SAN BRUNO, CALIFORNIA
HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

FIGURE 1-1

FACILITY MAP

IMU(SF)(044-0142)BASE-MAP.DWG – 08/16/95 – PS:xref – 1=1 – REV005

2.0 SITE CHARACTERIZATION

HPS has been occupied since 1776 and was acquired by the Navy in 1939. The main portion of HPS is situated on a long promontory located in the southeastern part of San Francisco extending eastward into San Francisco Bay (see Figure 2-1). The promontory is bounded on the north and east by San Francisco Bay and on the south and west by the Bayview Hunters Point district of San Francisco. The on-base property at HPS consists of about 936 acres, 493 of which are on land and 443 of which are below bay waters. Parcel B is a 66-acre tract of land located in the northeast portion of HPS. Field investigations were conducted at 16 IR sites and 2 SI sites at Parcel B during the RI.

This section presents site characterization information concerning HPS and Parcel B. Section 2.1 discusses the history of HPS. Section 2.2 discusses HPS' setting, including land use, climate, topography and surface water drainage, ecology, soils, geology, hydrogeology, current groundwater use and potential beneficial uses, and Parcel B historic areas. Section 2.3 presents the site characterization for each of the 18 sites investigated during the RI. Section 2.4 summarizes completed and ongoing removal actions at Parcel B. Section 2.5 presents a summary of the risk assessment prepared for Parcel B. Section 2.6 discusses potential RI data gaps, planned additional investigations, and planned mitigative measures for Parcel B.

2.1 HPS HISTORY

The promontory on which HPS is located has been recorded in maritime history since 1776, first as Spanish mission lands used for cattle grazing and later for its drydock facilities. HPS's history is discussed below focusing on the time period from 1939, when Congress passed legislation to acquire the land, to the present (after Navy acquisition).

In 1940, the U.S. Government received title to the land at Hunters Point and began developing it. From 1945 to 1974, the shipyard was predominantly used as a repair facility by the Navy. Additional acreage, mostly on the south side of the base, was acquired in 1957. The Navy operated the shipyard as a ship repair facility through the late 1960s. Hunters Point was deactivated in 1974 and remained relatively unused until 1976.

In 1976, the Navy leased 98 percent of Hunters Point to a private ship repair company, Triple A Machine Shop (Triple A). Triple A leased the property from July 1, 1976, to June 30, 1986. Triple A did not vacate the property until March 1987. During the lease period, Triple A used dry docks, berths, machine shops, power plants, various offices, and warehouses to repair commercial and Navy vessels. Triple A also subleased portions of the property to other businesses. In 1986, the Navy resumed occupancy of Hunters Point. Many of the subtenants under Triple A's lease remained tenants under the Navy's subsequent reoccupancy in 1986.

Because of the presence of hazardous materials from past shipyard operations, the Hunters Point property was placed on the National Priorities List (NPL) in 1989 as a Superfund site pursuant to CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). HPS then came under the administrative jurisdiction of the Treasure Island Naval Station in April 1990.

In 1991, HPS became slated for closure pursuant to the terms of the Defense Base Realignment and Closure Act of 1990 (BRAC). Closure activities at HPS involve environmental remediation activities and making the property available for nondefense use. On March 31, 1994, control of HPS was transferred from the Treasure Island Naval Station to the Naval Facilities Engineering Command, Western Division (WESTDIV) in San Bruno, California (now EFA WEST).

2.2 HPS SETTING

The following sections discuss the facility setting of HPS, including (1) land use, (2) climate, (3) topography and surface water drainage, (4) ecology, (5) soils, (6) geology, (7) hydrogeology, (8) current groundwater use and potential beneficial uses, and (9) Parcel B historic areas. A detailed description of the HPS setting is presented in Section 3.0 of the RI report (PRC 1996).

2.2.1 HPS and Surrounding Land Use

The land at HPS can be divided into three functional areas: (1) the industrial production area, which consists of the waterfront and shop facilities for the structural machinery, electrical, and HPS service groups; (2) the industrial support area, which consists of supply and public works facilities; and (3) the nonindustrial area, which consists of former Navy personnel residential facilities, recreational areas, and a restaurant. The industrial production area occupies the north and east portions of HPS (Parcels B and C); the industrial support area occupies the south and southwest portions of HPS (Parcels D and E); and the nonindustrial area occupies the northwest and central portions of HPS (Parcel A). Parcels B and E also contain nonindustrial buildings. The land surface at Parcels B, C, and D is mostly covered by asphalt, buildings, or other structures. The majority of the land in Parcel E remains unpaved.

The area surrounding HPS is designated by the San Francisco Planning Department (SFPD) as South Bayshore; however, local residents refer to the area as "Bayview/Hunters Point." South Bayshore is part of the City and County of San Francisco. South Bayshore is a low-density demographic area. According to the 1990 U.S. Census, the population density is approximately 8.9 persons per acre in this community. Approximately 50 percent of the residents in South Bayshore own their own homes, and 44 percent reside in rental properties. The predominant land uses of South Bayshore are industrial and residential. Over one-half of the land in South Bayshore is devoted to industrial use. Historically, various industries have been located in the South Bayshore area, including a wool pullery, a leather tannery, and slaughter houses.

Parcel B is bounded by Parcels A and C, San Francisco Bay, and the Ferrari Brothers property. Historically, the dominant land use of Parcel B has been for office and commercial buildings and light industrial production. The historical and current land use of Parcel B is summarized in Table 2-1. The future land-use pattern (see Figure 2-2), as selected by the San Francisco Mayor's Citizen Advisory Council on June 2, 1994, is entitled "Education and Arts." Based on this land-use pattern, Parcel B is expected be zoned to accommodate mixed uses, including an industrial complex, an educational complex, a mixed residential/retail complex, and a cultural/historical district.

2.2.2 Climate

The climate in the HPS area is characterized by partly cloudy, cool summers with little precipitation and mostly clear, mild winters with moderate precipitation. Air monitoring conducted at HPS indicates that the prevailing wind direction is west to east. Airborne dust and volatile emissions are therefore expected to be transported primarily east toward San Francisco Bay. The average and maximum wind speeds at HPS are approximately 5 and 10 meters per second, respectively. Normal annual rainfall in San Francisco as monitored at the San Francisco Federal Building is approximately 20 inches.

2.2.3 Topography and Surface Water Drainage

Between 70 and 80 percent of HPS land consists of relatively level lowlands constructed by excavating portions of surrounding hills and placing nonengineered fill materials along the margin of San Francisco Bay. Parcel B is located in the lowlands with surface elevations ranging from 10 to 40 feet above mean sea level (msl). The remaining land, which makes up much of Parcel A, is a moderate to steep sloping, northwest-trending ridge. Figure 2-3 shows ground surface elevation contour lines for HPS. Ground surface elevations are generally 0 to 18 feet above msl in the lowlands at Parcels B through E and 20 to 180 feet above msl at the ridge crest in Parcel A. Rock material from the ridge was used for filling in portions of the lowlands and constructing building pads except in the 36-acre industrial landfill in Parcel E, which was filled with rock materials mixed with industrial and municipal debris and refuse.

Surface water at HPS drains primarily in a sheet-flow pattern from either the highlands of Parcel A to the surrounding lowlands or from the lowlands themselves. In Parcel B and most of HPS, runoff is collected by the storm drain system and discharged to San Francisco Bay through outfalls. Approximately 10 percent of the surface of HPS, including undeveloped shoreline, pier areas, and a trailer parking lot, is not served by the storm drain system. Runoff from these areas and the sanitary sewer flow discharges to the City and County of San Francisco's combined storm and sanitary sewer system for treatment at the Southeast Wastewater Pollution Control Plant (SWPCP). This plant, a publicly owned treatment works, is located 1.1 miles north of the HPS main gate at Innes Avenue. No naturally occurring channelized drainage remains at HPS. Pre-existing drainage channels were filled in or modified by construction over the years. The location and distribution of the storm and sanitary sewer lines at Parcel B are presented in Figure 2-4.

2.2.4 Ecology

At HPS, San Francisco Bay is characterized by strong tidal currents. Physical structures, such as riprap and docks, serve as artificial habitats for estuarine life. The marine environment is disturbed as a result of activities in the bay. Several hundred types of plants and animals, including the following, are believed to live at or near HPS: terrestrial and marine plants and algae; benthic and water column-dwelling marine animals such as clams, mussels, amphipods, and fish; insects; amphibians;

reptiles; birds; and mammals. No threatened or endangered species are known to inhabit HPS or its vicinity, but a peregrine falcon has been observed at HPS.

The majority of Parcel B, approximately 75 percent, is covered by pavement and former industrial buildings. With little open space for flora and fauna, Parcel B is considered to have insignificant habitat value and poses an insignificant risk to terrestrial ecological receptors. Exposure pathways to terrestrial species are incomplete because of the lack of habitat and predominance of paved areas in Parcel B.

An ecological risk assessment is currently being prepared for Parcel F at HPS. The ecological risk assessment focuses on characterizing water and sediment quality in San Frnacisco Bay and impacts of contaminants in water and sediment on ecological receptors. Data from the ecological risk assessment may provide information concerning the distribution of hazardous substances in water and sediment near Parcel B relative to other areas in the bay.

2.2.5 Soils

Soils at HPS are derived from underlying rocks and weathered material were imported as fill. Parcel A is primarily covered by upland soils, and Parcels B through E are primarily covered by lowland soils. The upland soils are orthents of the cut-and-fill Urban Land Complex and Urban Land. The lowland soils are Urban Land-orthents, Reclaimed Complex. Lowland soils at HPS have a high liquefaction potential, especially shown in areas that have subsided as a result of the Loma Prieta earthquake of 1989. Table 2-2 provides a description of soils at each IR and SI site in Parcel B. Figure 2-5 shows the distribution of soils at HPS.

2.2.6 Geology

The peninsula forming HPS is within a northwest trending belt of Franciscan Complex bedrock known as the Hunters Point Shear Zone. HPS is underlain by six geologic units, the youngest of Quaternary age, and the oldest, the Franciscan Complex bedrock, of Jurassic-Cretaceous age. In general, the stratigraphic sequence of these geologic units, from youngest (shallowest) to oldest (deepest), is as follows: Artificial Fill; Slope Debris and Ravine Fill; Undifferentiated Upper Sand Deposits; Bay Mud Deposits; Undifferentiated Sedimentary Deposits; and Franciscan Complex Bedrock. The locations of these geologic units at HPS are shown in Figure 2-3. The elevations of the top of the bedrock, the top of the Bay Mud Deposits, and the thickness of the Bay Mud Deposits are shown in Figures 2-6 through 2-8, respectively.

The geology of Parcel B primarily consists of bedrock-derived Artificial Fill. The thickness of the Artificial Fill ranges from less than 1 foot to 80 feet and generally increases from south to north. Industrial fill and Undifferentiated Upper Sand Deposits occur locally within or beneath the Artificial Fill. Industrial fill occurs locally in the western portion of Site IR-18 in Parcel B (see Figure 2-5). In the northern portion of Parcel B, the Artificial Fill in the low-lying areas is generally underlain by Bay Mud Deposits. The Bay Mud Deposits are generally absent in the southern portion of Parcel B next to the 1935 shoreline. In these areas, the Artificial Fill directly overlies bedrock or Undifferentiated Sedimentary Deposits. Undifferentiated Sedimentary Deposits are present locally in some areas of Parcel B, such as at IR-07, IR-18, and IR-25. The depth to Franciscan Complex Bedrock from the ground surface in Parcel B varies from less than 1 foot in the southern portion of the parcel to greater than 80 feet in the northern portion of the parcel. Table 2-2 presents a summary of the geology at each IR and SI site at Parcel B.

2.2.7 Hydrogeology

The two aquifers and one water-bearing zone identified at HPS are (1) the A-aquifer, (2) the B-aquifer, and (3) the bedrock water-bearing zone. The general relationship between the A-aquifer, the bay mud aquitard, and underlying bedrock water-bearing zone, as well as the general direction of groundwater flow are shown in Figure 2-9, which is a conceptual hydrogeologic model of HPS. Table 2-3 presents information concerning the hydrogeologic properties of the A-aquifer and bedrock water-bearing zone at each IR and SI site.

Only the A-aquifer and bedrock water-bearing zone are present throughout Parcel B. The saturated Undifferentiated Sedimentary Deposits (the B-aquifer), are also present in Parcel B at IR-07, IR-18, IR-25, and IR-46; however, the full extent of the B-aquifer in Parcel B was not delineated in the RI. The B-aquifer was not investigated at IR-07, IR-18, and IR-46 because it is overlain by the bay mud aquitard, and the potential for groundwater contamination in the B-aquifer at these sites is low. The B-aquifer is overlain directly by the A-aquifer at IR-25, IR-60, and IR-62 and is considered to be a part of the A-aquifer. The B-aquifer and Bay Mud Deposits are absent in excavated areas near the former 1935 shoreline.

The A-aquifer and bedrock water-bearing zone in Parcel B are discussed below.

A-aquifer

The A-aquifer consists primarily of saturated Artificial Fill and, to a lesser extent, Undifferentiated Upper Sand Deposits. Groundwater levels measured in A-aquifer wells at Parcel B range from 2 to 15 feet below ground surface (bgs). Groundwater levels are generally higher during the wet season (winter and spring) than in the dry season (summer and fall). Based on the groundwater levels measured in February and August 1994, the seasonal fluctuation of groundwater levels ranges from 0.3 to 3 feet but is generally less than 2 feet. Figures 2-10 through 2-12 show the A-aquifer groundwater elevations and their contour lines based on water levels measured in February and August 1994 and in May 1995. Groundwater flow in the A-aquifer in Parcel B is generally away from the Parcel A bedrock ridge toward the bay to the north and northeast. The A-aquifer within 400 feet of the shoreline is impacted by the tides in the bay (see Figure 2-13). The total dissolved solids (TDS) concentration of groundwater in the A-aquifer of Parcel B ranges from 433 to 28,000 milligrams per liter (mg/L), and the salinity ranges from 350 to 28,000 mg/L.

Bedrock Water-Bearing Zone

The bedrock water-bearing zone was encountered in the southern portion of Parcel B near IR-06 and IR-07. Water levels in the bedrock water-bearing zone range from 4 to 40 feet bgs. The groundwater levels are generally higher in the wet season than in the dry season, indicating that precipitation is one of the indirect recharge sources of the bedrock water-bearing zone. TDS concentrations of the bedrock water-bearing zone vary from 355 to 4,540 mg/L, and salinity varies from 250 to 4,300 mg/L.

2.2.8 Current Groundwater Use and Potential Beneficial Uses

Groundwater at Parcel B is not used for any purpose. A-aquifer groundwater from Parcel B is not considered a viable potential drinking, industrial, or irrigation water source, as discussed below.

Direct recreational or navigational potential beneficial uses of Parcel B groundwater have not been identified.

Metal concentrations in Parcel B groundwater samples collected from A-aquifer monitoring wells near the shoreline were compared to MCLs, tap water PRGs, NAWQC, as well as to HGALs.

Analytical results of Parcel B groundwater samples collected from the A-aquifer and bedrock water-bearing zone were compared to drinking water standards, including primary and secondary MCL, additional constisutents, and other classifications, as well as to Albion Springs, and SFWD water and recycled water standards. Although it is theoretically possible to drink groundwater that has been desalinated from a source with a TDS content of 3,000 to 10,000 mg/L, A-aquifer groundwater is typically nonpotable based on its high TDS content, hardness, salinity, and specific conductivity. Bedrock water-bearing zone groundwater is typically also very hard and has a detectable taste.

The federal secondary standard MCL for TDS is 500 mg/L (Safe Drinking Water Act 40 U.S.C. 300f et seq., 40CFR 141 and 143), California criterion for a potential drinking water source is 3,000 mg/L (California State Water Resources Control Board Resolution No. 88-63, Adoption of Policy Entitled "Sources of Drinking Water") and the federal criterion for a potential drinking water souce is 10,000 mg/L (U.S. EPA 1992).

At some Parcel B locations in the A-aquifer, TDS content ranges from 433 to 34,100 mg/L, with an average TDS content of about 1,760 mg/L. These TDS concentrations indicate that limited fresh water (less than 1,000 mg/L) could be pumped from wells with short-term production potential; however, it is likely that if groundwater were to be pumped at these locations, the fresh water supply would be irreveribly degraded by saline bay-water intrusion because the nearby San Francisco Bay would recharge near-shore groundwater.

Additionally, if groundwater were pumped from the A-aquifer over a long-term period, groundwater withdrawals would likely cause land surface settling and subsidence because of the settling capacity of noncompacted fill materials that make-up the A-aquifer. Long-term withdrawals from the A-aquifer would likely lead to settling and subsidence as the A-aquifer becomes dewatered faster than saline bay water recharge.

At some Parcel B locations in the bedrock water-bearing zone, TDS content ranges from 355 to 5,380 mg/L, with an average TDS content of about 1,760 mg/L. These TDS concentrations indicate that limited amounts of fresh water, less than 1,000 mg/L, could be pumped from wells with short-term production potential; however, it is likely that the fresh water supply would be eliminated in a short time because bedrock water-bearing zone groundwater is present within a thin, buried-surface weathered zone and within buried bedrock fractures of limited extent.

Finally, the long-term abundance of the high quality City of San Francisco water supply from Yosemite Falls through the Hetch Hetchy aqueduct, as well as city policy and permit requirements that discourage groundwater development within the city, may preclude the development of groundwater at Parcel B as a drinking water supply.

Analytical results for A-aquifer and bedrock water-bearing zone groundwater samples were also compared to industrial water standards for cooling water and industrial boiler use, as well as to Albion Springs and SFWD water and recycled water standards. A-aquifer groundwater is typically unsuitable for industrial cooling water use because of its high chloride, TDS, hardness, calcium, magnesium, and sulfate content. Bedrock water-bearing zone groundwater is also typically unsuitable for industrial cooling water use because of high chloride, TDS, hardness, magnesium, and sulfate content. Bedrock water-bearing zone groundwater is also typically unsuitable for industrial low-pressure boiler use because of its high iron, TDS, and hardness content. Bedrock water-bearing zone groundwater is typically unsuitable for industrial intermediate- and high- pressure boilers because of its high iron, TDS, and hardness content, as well as its high calcium and magnesium concentrations.

Finally, analytical results for A-aquifer and bedrock water-bearing zone groundwater samples were compared to irrigation water standards for salinity, sodium content, alkalinity, irrigation class, tolerance to turfgrasses, and sensitivity to trees and shrubs, as well as to Albion Springs and SFWD water and recycled water standards. A-aquifer groundwater typically has a very high salinity hazard, and irrigation use is therefore not recommended. A-aquifer groundwater also has a high sodium content, and its salinity makes it unsuitable for turfgrass, tree, and shrub irrigation. Bedrock water-bearing zone groundwater also typically has a very high salinity content, making it unsuitable for turfgrass, tree and shrub irrigation.

The only beneficial use of Parcel B groundwater that has been identified is for the preservation of salt water aquatic life as Parcel B groundwater is discharged into the southern portion of San Francisco Bay. Inital screening of analytical results for these groundwater samples indicate that nickel is present in the groundwater at concentrations that exceed the NAWQC by up to approximately 10 times, or one order of magnitude; however, it is anticipated that these exceedances may represent ambient groundwater quality, which will be determined by establishing Hunters Point groundwater ambient levels (HGAL) for metals. Moreover, the relatively very small volumes of groundwater entering San Francisco Bay from Parcel B are expected to be immediately diluted by the vast volume of groundwater entering the bay during, for example, a mean tidal cycle. It is therefore unlikely that metals in a-aquifer groundwater from Parcel B at concentrations exceeding NAWQC would negatively impact salt water aquatic life.

By comparing the concentrations of each metal that exceeds its NAWQC, the level of dilution of groundwater as groundwater enters the southern portion of San Francisco Bay can be estimated for the metal to be below its NAWQC. For example, the highest nickel concentration detected in monitoring well IR07MW21A2, which is about 100 feet from the shoreline, is 71.8 μg/L, or 8.76 times its NAWQC of 8.2 μg/L. A groundwater-bay water dilution of less than 9 would therefore be required to bring this nickel value to below its NAWQC, ignoring any nickel attenuation effects as groundwater migrates from the well toward the bay. The amount of A-aquifer groundwater entering the bay is roughly less than 6.3 acre-feet per day, or about 3.2 acre-feet for 12.4 hours the average period of the mean tide. This volume results in a potential flushing volume of about 489,000 acre-feet during a mean tide in the southern portion of the bay, or a potential flushing dilution factor of 153,000 times. Even if all of A-aquifer groundwater exceeded the nickel NAWQC, which it does not, its likely dilution in the bay is several tens of thousands of times higher than needed to bring the nickel values to well below analytical detection levels. It is therefore unlikely that metals in A-aquifer groundwater from Parcel B at concentrations exceeding NAWQCs would have detectable adverse effects on saltwater aquatic life in the bay.

2.2.9 Parcel B Historic Areas

Pumphouse No. 3 at IR-26 is considered by the National Register of Historic Places to be of potential historic significance. This building is located north of Dry Dock 3, which may be designated a historic area by the City and County of San Francisco. Although Building 140 was not considered a site with possible chemical contamination, it is physically located within a designated IR site (IR-26). The potential impact of the location of a historic building within an IR site is that any proposed remedial action must minimally affect that building unless approved by the California State Historic Preservation Office.

In 1989, a survey of the historic resources at HPS identified the area surrounding and next to Dry Docks 2 and 3 of Parcels B and C as the Hunters Point Commercial Dry Docks Historical District. No other structures within Parcel B have been identified as qualifying for placement on the National Register of Historic Places.

2.3 IR AND SI SITE CHARACTERIZATION

IRP sites at HPS undergo a sequence of investigations beginning with a preliminary assessment (PA), which involves record searches, interviews, and limited field investigation. Sites needing further investigation are carried through to the SI phase. The SI investigation involves the collection and evaluation of additional field data. Finally, sites needing more investigation are carried through to the RI phase. The RI involves characterizing the nature and extent of and threat posed by hazardous substances and hazardous materials, and assessing the risks posed by each site to human health and the environment.

To date, 78 sites at HPS have been identified under the Navy's IRP. Eighteen of these sites are located within the boundaries of Parcel B. These sites include “IR” and “SI” sites. Designation of a site as “IR” indicates that the site has undergone PA- and SI-level investigation under the CERCLA process and has been recommended for further investigation at the RI level. Designation of a site as "SI" indicates that the site has undergone PA- and SI-level activities and no further investigation is necessary. Figure 2-14 shows the locations of the IR and SI sites at Parcel B.

RI- and SI-level field investigations at Parcel B were conducted at 16 IR sites and two SI sites, respectively. Results of the field investigation were used to characterize the geology, hydrogeology, and nature and extent of contaminants at each IR and SI site, to evaluate the fate and transport of contaminants at the sites, and to evaluate the potential risks and hazards present at each IR and SI site.

Analytical results from the field investigation were subjected to a two-part screening process. Soil and groundwater samples were initially screened to ascertain whether a suspected release of a hazardous substance has occurred to the environment. Because metals are naturally present in soil, detections of metals were compared to Hunters Point ambient levels (HPAL) for all soils to determine whether the concentration of the metal falls within the naturally occurring distribution of the analyte with 95 percent confidence. Detections of a metal at a concentration exceeding its HPAL are assumed to result from a release of the metal to the environment. Table 2-4 presents HPALs for metals in soil at HPS.

Hunters Point groundwater ambient levels (HGAL) have been developed based on existing groundwater data from uncontaminated areas at HPS. Appendix A presents HGALs for the metals in A-aquifer groundwater at HPS. The concentrations of metals in Parcel B groundwater were compared to groundwater HGALs to identify suspected releases to groundwater. Detections of non-naturally occurring compounds (that is, organic compounds and hexavalent chromium [chromium VI]) were assumed to result from a release of that hazardous substance to the environment.

Hazardous substance concentrations that exceeded screening criteria levels during the initial screening process were suspected to be the result of a release of the substance to the environment. The distribution of each hazardous substance in soil and groundwater was evaluated to (1) identify potential source areas, (2) determine possible migration pathways, and (3) determine the areal extent and depth of the suspected release. Soil and groundwater that contained hazardous substances resulting from a suspected release were subjected to a second screening process. The screening criteria for the second screening process were developed to focus on potentially significant hazardous substances and to provide a framework against which to evaluate the relative significance of the occurrence of hazardous substances. Soil and sediment analytical results were compared to U.S. EPA Region IX preliminary remedial goals (PRG) for residential land use or the more stringent California Environmental Protection Agency (Cal/EPA) PRGs, if available. Groundwater analytical results were screened against the following screening criteria:

- U.S. EPA Region IX PRGs (February 1995) for tap water or the more stringent Cal/EPA PRGs, if available
- U.S. EPA Title 40 Code of Federal Regulations (CFR) Parts 141 and 143 or Title 22 California Code of Regulations maximum contaminant levels (MCL) for drinking water sources, whichever is more stringent
- U.S. EPA national ambient water quality criteria (NAWQC) for the protection of saltwater aquatic life

Although petroleum hydrocarbons are not hazardous substances as defined by CERCLA, these compounds were also screened in the Parcel B RI report under the Navy's IRP.

Development of petroleum hydrocarbon action levels is ongoing throughout the United States. In California, various risk-based approaches to establishing petroleum hydrocarbon action levels are underway through the Senate Bill 1764 Committee. The committee's finding will result in revisions to RWQCB's Leaking Underground Fuel Tank (LUFT) field manual (RWQCB 1989). The LUFT field manual is intended to provide practical guidance to regulatory agencies responsible for dealing with leaking fuel tanks. Promulgated changes to the LUFT field manual are not scheduled for completion until late 1996 or 1997.

Because no regulatory guidance is available for screening total petroleum hydrocarbons (TPH) in soil and groundwater, screening levels for TPH as diesel (TPH-d) and TPH as gasoline (TPH-g) were developed for the RI using the risk-based cleanup levels developed for the Moffett Field Naval Air Station (Moffett Field, Sunnyvale, California) and The Presidio of San Francisco, California (The Presidio) (PRC 1996). Following discussions with U.S. EPA and DTSC, the TPH screening criteria for the FS were modified to also consider the groundwater cleanup values for TPH presented in the San Francisco International Airport cleanup requirement (RWQCB 1995). Petroleum hydrocarbon screening levels used for the FS at HPS are presented in the table below. HPS site-specific TPH standards are currently being developed to evaluate potential risks to the environment and will be used as the TPH cleanup standards for the FS for soil and groundwater with TPHs and other CERCLA hazardous substances, and in the petroleum corrective action plan for soil and groundwater containing TPHs only. The petroleum hydrocarbon corrective action plan is scheduled for completion in mid 1997.

HPS SCREENING CRITERIA FOR PETROLEUM HYDROCARBONS IN SOIL AND GROUNDWATER

Petroleum Hydrocarbon	Soil (mg/kg)	Groundwater (μg/L)
TPH-g	100	100
TPH-d, TPH-mo, TOG, or TRPH	1,000	100

Notes:

mg/kg	Milligram per kilogram
μg/L	Microgram per liter
TOG	Total oil and grease
TPH-mo	TPH as motor oil
TRPH	Total recoverable petroleum hydrocarbons

These screening levels will be used to estimate soil and groundwater volumes requiring remediation for cost estimating purposes. Toxicity testing will be conducted to develop site-specific TPH toxicity levels and will be incorporated into the remedial design.

Analytical results from the field investigations were used to evaluate potential risks and hazards to human health. A human health risk assessment (HHRA) was prepared to evaluate risks and hazards to current workers and future workers who may be present under the light industrial future land use scenarios proposed for Parcel B at 86 0.5-acre exposure areas. The HHRA also evaluated risks to child and adult residents who may be exposed to environmental media at one of 221 2,500-square foot (ft^2) exposure areas at Parcel B under the future residential land use scenarios. Appendix B summarizes the HHRA methodology.

The following sections present site characterizations for the 16 IR and two SI sites at Parcel B. The site characterizations describe the site and hazardous substances detected above screening criteria at the site, and discuss removal actions and planned land use at the site. The geology and hydrogeology at Parcel B is presented in Tables 2-2 and 2-3, respectively. Table 2-5 summarizes suspected sources of hazardous substances at each of the IR and SI sites and presents the range of concentrations of hazardous substances detected in environmental media at concentrations that exceeded both the initial and secondary screening processes. Detailed information concerning the presence of all hazardous substances is presented in the Parcel B draft-final RI report (PRC 1996).

2.3.1 IR-06

Site IR-06 was one of the 12 sites identified during the initial assessment study (IAS) conducted by the Navy in 1984 as part of the Navy Assessment and Control of Installation Pollutants (NACIP). The site was originally designated as IAS Site 10 and was redesignated IR-06 in 1988 when the site was incorporated in the Navy's IRP. IR-06 was included in the Group II (later renamed Operable Unit II) site investigations. RI activities conducted at IR-06 between 1988 and 1991 were first reported in the "Draft Operable Unit II Remedial Investigation Report".

Site IR-06, referred to as the "Tank Farm," is the former location of 18 aboveground tanks and former Buildings 111 and 112, which housed the lubrication oil and diesel fuel pump houses. The Tank Farm was constructed in 1942 along what had been the shoreline in 1935 and was used by the Navy until 1974 to store fuel and lubrication oil. From the Tank Farm, fuel and lubrication oil were distributed to the berths north and northeast of IR-06 through the pump houses and underground lines. In the early 1940s, diesel oil was reportedly spilled from a ruptured tank at IR-06 when, apparently, the contents of a 286-barrel tank (about 12,000 gallons) overflowed the berm. The spilled diesel oil was recovered and taken to the Oil Reclamation Ponds at IR-03 in Parcel E. Triple A reportedly used the Tank Farm from 1976 until 1986. Stoddard solvent may have been stored in Tanks 7 and 8 during this period.

All of the tank facilities, including the tanks, pump houses (Buildings 111 and 112), support racks, and associated piping within the bermed areas, were removed as part of the removal action conducted at IR-06. Approximately 140 cubic yards (yd^3) of soil were excavated within Berms 1 through 4 during the removal action and disposed of off site. The site was graded, and a liner was installed as a temporary cap.

Structures that remain at IR-06 include a truck washout ramp and four berms and trenches containing fuel distribution and steam lines that run from the former pump houses to the fueling berths north of IR-06.

The ground surface at the Tank Farm is mostly flat and, except for the berms, paved with asphalt or concrete. Robinson Street, located south of the Tank Farm, is separated from the Tank Farm by a steep slope that forms the southern portion of Berms 1, 3, and 4.

Chemicals of potential concern (COPC) in soil at IR-06 are lead, polynuclear aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), and pesticides.

Lead detected in shallow soil is attributable to the sandblast grit and petroleum hydrocarbons released at IR-06. The PAHs can be associated with TPH-d and related to the release from the tank farm and fuel distribution pipelines formerly located at IR-06. The source of PCBs may be related to the waste oil stored in the tanks at IR-06. The source of the pesticide aldrin in surface soil at the tank farm is unknown.

COPCs in bedrock water-bearing zone groundwater at IR-06 are the metals arsenic and chromium VI; the volatile organic compounds (VOC) chloroform, 1,2-dichloroethene (1,2-DCE), trichloroethene (TCE), perchloroethene (PCE), and vinyl chloride; and the pesticide heptachlor epoxide. Antimony, arsenic, and beryllium were detected in groundwater samples collected from A-aquifer monitoring wells at concentrations exceeding their respective PRGs. The source of these metals at IR-06 is the fill materials.

Most of the bedrock water-bearing groundwater samples containing VOCs at concentrations exceeding the screening criteria were collected from monitoring wells screened in the A-aquifer or the bedrock water-bearing zone in the area north of Berms 1, 2, and 3. The suspected source of the VOCs in groundwater is releases in the area immediately north of Berms 1, 2, and 3 and within the berms themselves. The presence of 1,2-DCE and vinyl chloride probably result from the degradation of PCE and TCE. In addition to being present in the area near Berms 1, 2, and 3, TCE was also consistently detected at concentrations exceeding its screening criterion in samples collected from a well screened in the bedrock water-bearing zone located approximately 10 feet east of Berm 4. The specific source of the TCE in this well is unknown, and soil in this area does not appear to contain TCE. Data from nearby bedrock water-bearing zone wells suggest that the extent of TCE at concentrations exceeding its screening criterion in this area is limited.

The semivolatile organic compounds (SVOC) 1,4-dichlorobenzene; bis(2-ethylhexyl)phthalate; carbazole; naphthalene; pentachlorophenol; and phenanthrene were detected at concentrations exceeding their screening criteria in A-aquifer monitoring wells near the tank farm. The source of SVOCs in groundwater at IR-06 may be attributable to the SVOC-affected soil at IR-06.

The pesticide heptachlor epoxide was detected in a bedrock water-bearing zone monitoring well located south of Berms 1 and 2. The source of heptachlor epoxide in groundwater at this location is unknown.

TPH-d and TPH-mo are the petroleum hydrocarbons most frequently detected in groundwater samples collected from monitoring wells screened in the A-aquifer and bedrock water-bearing zone. TPH-d was detected at concentrations exceeding the screening criterion in two separate areas. Both areas coincide with areas of TPH-d in soil. One area is downgradient of Berm 4. This area is primarily confined to the A-aquifer; however, TPH-d was detected in groundwater in the bedrock water-bearing zone immediately under Berm 4. The other area is located downgradient and north of Berms 1 and 2. This area appears limited to the A-aquifer. The distribution of TPH-mo at concentrations exceeding its screening criterion in groundwater is generally similar to that of the distribution of TPH-d. Generally, TPH-mo concentrations were lower than TPH-d concentrations in groundwater samples when both analytes were detected. TOG was detected at concentrations exceeding its screening criterion in A-aquifer monitoring wells located north of Berms 1, 3, and 4.

The source of TPH-d, TPH-mo, and TOG in groundwater may be attributable to the petroleum hydrocarbon-based fuel stored in the aboveground storage tanks (AST) formerly located at IR-06.

A total of approximately 2,600 yd^3 of soil contaminated with organic compounds, metals, and petroleum hydrocarbons are planned for removal from IR-06 as part of the ongoing IR-06 Tank Farm soil removal action. The actual extent of soil removed at IR-06 will be reported in the remedial design report. The purpose of the removal action is to remove hazardous substances in soil at eight areas of IR-06 that pose a threat to human health and the environment.

Currently, there are no tenants at IR-06. According to the City of San Francisco's proposed reuse plan (see Figure 2-2), IR-06 will be used for commercial and residential purposes such as retail galleries, artisan studios, artist residences and businesses, warehouses, and hotels.

2.3.2 IR-07

Site IR-07 occupies approximately 9 acres in the northwestern portion of Parcel B and includes a portion of the San Francisco Bay intertidal zone. Based on the results of the IAS, IR-07 was subdivided into three areas, the Painting Area, the Sandblast Fill Area, and the Additional Area.

The Painting Area was formerly used to sandblast and paint submarine superstructures and is paved with asphalt. Sandblasting operations may have generated paint chips containing metals that were deposited in this area. Underground piping is also suspected to be present at the Painting Area; however, this underground piping was not found during the RI.

The Sandblast Fill Area may have been used as a disposal site for sandblast grit generated from the Painting Area (EMCON 1987a). The southern portion of this area is paved with asphalt. Underground piping associated with aboveground and underground fuel tanks located at Building 146 of IR-23 was suspected to be present beneath this asphalt surface. However, geophysical testing did not confirm the presence of piping at IR-07.

The Additional Area may have been associated with the nearby Triple A Waste Oil Disposal Area (IR-18) and used to dispose of sandblast waste and possibly waste liquids or oils on the ground surface. Most of this area is paved with asphalt.

Lead is the most widespread COPC in soil at IR-07 at concentrations exceeding its screening criterion, and its presence is probably attributable to spent sandblast grit. Other metals, including beryllium and zinc, were detected at concentrations exceeding screening criteria in soil samples collected at IR-07. This area of metals-affected soil is generally located within the area of lead-affected soil. Metals are present in soil at concentrations exceeding screening criteria predominantly in the Additional Area. These metals are beryllium, copper, lead, manganese, and zinc. Of these metals, lead is present over the largest area at IR-07. The source of these metals may also be attributable to spent sandblast grit.

TOG was detected at concentrations exceeding its screening criterion in five isolated areas at IR-07. The presence of TOG probably results from waste oil released in these areas. SVOCs and lead are common constituents of waste oil and are probably associated with the TOG detected in soil. The TOG and associated SVOCs in soil at IR-07 are generally located in the Additional Area. TOG is also present in soil at concentrations exceeding its screening criterion in the Painting Area, in two areas of the Sandblast Fill Area, and in the Additional Area along the bay shore and fenceline. The source of TOG detected in soil at IR-07 is probably waste oil disposed of in the Sandblast Fill Area and in the Additional Area, and petroleum hydrocarbons spilled in the Painting Area.

There are no previous or currently planned removal actions at IR-07; and there are no current tenants at IR-07. According to the City of San Francisco's proposed reuse plan for IR-07, the northern portion of IR-07 will be used as open space, the southwestern portion will be used for future development, and the southeastern portion will be used as a business park and for research and development.

2.3.3 IR-10

Site IR-10 consists of Building 123, the Battery and Electroplating Shop, which was used for submarine battery overhaul, battery storage, and electroplating from 1944 through 1974. Next to the southeast end of Building 123 is the former location of Building 124 (demolished), which is located within the boundaries of IR-24 but which has been investigated as part of IR-10. Building 124 was the Acid Mixing Plant, where sulfuric acid and distilled water were combined to form electrolyte for batteries. Five wooden upright tanks were formerly located between Buildings 123 and 124 consisting of one 7,500-gallon sulfuric acid tank; two 5,000-gallon distilled water tanks; and two 5,000-gallon electrolyte solution tanks. Based on an inspection of aerial photographs, the tanks were removed between 1979 and 1981. Dip tanks containing solvents and plating solutions were located in the northern corner of Building 123. Nine large sumps located in the southeast corner of Building 123 formerly contained high-voltage transformers.

Between 1944 and 1974, spent electrolyte that contained metals, primarily lead and copper, from batteries to be reconditioned was reportedly discharged to the floor drains or spilled on the floor of Building 123 (Westec 1994). Spills may also have occurred at the loading docks along the southwest side of the building.

Waste acids containing cyanide, chromates, and other metals were generated by plating operations in Building 123. Cyanide wastes from the plating operations were reportedly collected in containers and disposed of in the industrial landfill at HPS (IR-1/21); however, plating solutions containing chromates and metals may have been released into the floor drains in Building 123. The floor drain system connected directly to the storm drain system, which discharged to San Francisco Bay. Transformers formerly located in sumps in Building 123 contained petroleum hydrocarbon-based dielectric fluids that may have contained PCBs.

COPCs in soils are arsenic, lead, VOCs, SVOCs, and PCBs. Petroleum products were also detected in soil at concentrations exceeding screening criteria.

Arsenic exceeded its HPAL in only 2 percent of the samples collected at IR-10 at isolated locations. The low frequency of HPAL exceedance and the isolated distributions of arsenic do not indicate a release. Shallow soils contained lead and nickel at concentrations exceeding their screening criteria in the vicinity of Building 123 west of Lockwood Street. The distribution of lead in surface soil is unknown at borings IR10B008 and IR10B009 indicate a surface release of lead near the loading docks along the southwest side of Building 123. The distribution of nickel in soil at borings IR10B007 and IR10B008 indicate a release of nickel near the southwest side of Building 123. The source of nickel is unknown.

TCE exceeded its PRG in soil beneath and around Building 123 at depths ranging from near ground surface to below the water table. The maximum TCE concentrations were detected near the acid drain lines running below the floor at the northwest end of Building 123. TCE-affected shallow soil is confined to the area around soil borings.

The following five SVOCs were detected in soil inside Building 123 at concentrations exceeding their screening criteria: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and dibenzo(a,h)anthracene. SVOCs were detected in two isolated areas at stations IR10B004 and IR10MW31A1 within the upper 2 feet of soil. The source of SVOCs is unknown.

The PCB Aroclor-1260, detected in surface soil at IR51SS04, is attributable the former transformer site (IR-51) located within IR-10.

TCE was detected in groundwater in the A-aquifer directly beneath and around the area of TCE-affected soil. TCE was also detected in the IR-10 well farthest downgradient from Building 123, indicating downgradient migration of TCE in groundwater. The only continuous volume of metals-affected groundwater identified at IR-10 contains chromium VI. Chromium VI concentrations exceeding the NAWQC were detected in groundwater beneath and northwest of Building 123. A chromium VI release is therefore indicated.

No previous or currently planned removal actions are associated with IR-10. The current tenant at IR-10 is EFA West, which uses Building 123 as an electrical substation. According to the City of San Francisco's proposed reuse plan (see Figure 2-2), IR-10 will be used for commercial and residential purposes such as retail galleries, artisan studios, artist residences and businesses, warehouses, and hotels.

2.3.4 IR-18

Site IR-18 was initially one of the Triple A sites identified during the San Francisco District Attorney's (SFDA) investigation in January 1988. IR-18 was included in the PA investigation under the designation PA-18. As shown in Figure 2-14, IR-18 is a 3.6-acre, asphalt-paved area in the parking lot next to Donahue Street west of IR-07. Currently, no structures or tenants are located at this site.

COPCs in soil are arsenic, beryllium, lead, PCBs, and PAHs. Petroleum products were also detected in soil at concentrations exceeding screening criteria.

Arsenic and beryllium exceeded their HPALs in only 2 and 3 percent of the samples collected at IR-18, respectively, and are probably attributable to their ambient concentrations in Artificial Fill material. Lead was detected at concentrations exceeding its screening criterion in soil located off site and in shallow soil samples collected from a boring and a test pit located along the western fenceline.

SVOCs were detected in soil in the northwestern portion of IR-18 in about the same area as the detected petroleum hydrocarbons. PCBs were detected in surface soil in the area of the fenceline at IR-18. PCBs are present in near-surface soils within the same area as petroleum hydrocarbons. An area of soil containing the PCB Aroclor-1254 is located at the northwestern fenceline of IR-18.

Lead, SVOCs, PCBs, and petroleum hydrocarbons detected is soil at concentrations exceeding the screening criteria at IR-18. The contaminants probably result from ground surface releases of waste oil, primarily near the IR-18 western fenceline. The waste oil released at IR-18 contained TPH-mo, TRPH, and TOG, and also may have contained residual lead from the combustion of leaded fuels and PAHs, which are products of incomplete combustion.

Antimony, mercury, nickel, silver, and thallium were detected in groundwater at concentrations exceeding their screening criteria in groundwater; however, none of these metals exceeded their PRGs or MCLs except for thallium, which exceeded its MCL in the groundwater sample collected from well IR18MW22A.

There are no previous or currently planned removal actions at IR-18. According to the City of San Francisco's proposed reuse plan (see Figure 2-2), the northwest half of IR-18 will be used for future development and the southeast half will be used as a business park and for research and development.

2.3.5 IR-20

Site IR-20 is located in the west-central portion of Parcel B. IR-20 is a paved area of less than 0.5 acre consisting of Building 156 and an adjacent waste storage yard. Prior to 1986, IR-20 was used by Navy tenants to store a variety of reclaimed waste oils and chemicals.

Aerial photographs taken between 1976 and 1986 reveal a pond-like feature north of Building 156 resulting from a clogged storm drain. Also, the contents of a sump inside Building 156 were sampled and analyzed during the SI, and later removed.

Lead, PCBs, and PAHs are COPCs in soil. Petroleum hydrocarbons were also detected in soil at concentrations exceeding screening criteria.

The chemicals and reclaimed waste oils stored in the southwest portion of the site and the sump inside Building 156 may be the sources of contaminants detected at IR-20. Lead and chromium VI were detected at concentrations exceeding their PRGs in soil samples collected at IR-20. Soil north of Building 156 contains the PCB Aroclor-1260, TPH-d, and TPH-g. The chemicals and reclaimed oil formerly stored in the southwest portion of the site and the sump inside Building 156 may be the source of contaminants detected at IR-20.

Antimony, lead, manganese, and mercury were detected in groundwater at concentrations exceeding their screening criteria. These four metals may be related to their high concentrations in the sump within Building 156 and their high concentrations in soil. Benzene, TPH-g, and TOG were detected in the groundwater sample collected from well IR20MW17A at concentrations exceeding their screening criteria. These three contaminants may be related to petroleum hydrocarbons detected in soil at IR-20.

There are no previous or currently planned removal actions at IR-20. Currently, there are no tenants at IR-20. The future development of IR-20 is unspecified in the City of San Francisco's proposed reuse plan (see Figure 2-2).

2.3.6 IR-23

Site IR-23 was one of 40 sites identified during the PA conducted in 1990. Site IR-23 is an irregularly shaped area in the northwestern portion of Parcel B and is bounded on the north by San Francisco Bay.

IR-23 contains Building 121, the former Navy Civilian Training Center; Building 146, the Photograph Development Laboratory; and Building 144, the Lavatories. IR-23 also contains two demolished building sites, the former Maintenance Service Center (Building 161), and the former Paint Storage Shed (Building 162). The former Saltwater Pumphouse (Building 145) and UST S-136 are also located at IR-23, but these features were investigated under the IR-60 investigation (see Section 2.3.16).

No reported activities at Building 121 would have resulted in releases of hazardous substances to the environment. Building 146, the Photograph Development Laboratory, is located at the western boundary of IR-23. Two ASTs that may have been used to store diesel and heating oil were removed in 1995 from a secondary containment area in the northeast corner of Building 146. During inspections of Building 146 in 1991 and 1993 during the SI, staining was observed on the ground surface near the ASTs. Staining on the asphalt surface outside the northwest corner of the building was also observed. Also during the SI, three sealed sumps in the southeast corner of the building and two metal floor plates in the northwest portion of the building were observed.

The site of Building 161, the former Maintenance Service Center, is covered with soil and native vegetation. No spills or releases are reported to have occurred at Building 161. The site of Building 162, the former Paint Storage Shed, has been excavated to create a boat ramp. A small building, Building 144, is still present at IR-23 and contains lavatories.

The site of Building 145, the former Saltwater Pumphouse, is currently a square concrete pad measuring approximately 18 by 18 feet. The concrete pad contains grates covering a 10-foot deep vault that contains salt water pumps. The pumps were used to supply fire hydrants with salt water. Building 145 was investigated as part of IR-60. Section 2.3.16 discusses the investigation conducted at IR-60.

Two USTs have been removed from IR-23. Tank S-135 was located near Building 118 in IR-23. Tank S-136 was a steel UST that had a capacity of 750 gallons and contained fuel oil. A tank inspection revealed that about one-quarter of the length of the tank had corrosion holes and a puncture hole was present. This tank was removed May 23, 1993.

Tank S-136 was a 750-gallon, steel fuel oil AST located approximately 45 feet southeast of Building 146. Tank S-136 was removed in May 1993 during Phase II of the HPS UST program. Soil sample analytical results from the excavation of the tank indicated that petroleum hydrocarbons had been released into soil and possibly groundwater near the tank. Currently, the former tank site is covered with soil and native vegetation. A concrete pad and a storm drain are located east of the former tank site.

COPCs in soil are arsenic, beryllium, lead, PAHs, PCBs, and pesticides. Petroleum products were also detected in soil at concentrations exceeding screening criteria. The contaminants at IR-23 appear to result from surface releases of TPH-mo and TPH-d compounds and UST leaks or spills of TPH-d.

Arsenic and beryllium exceeded their HPALs in only 7 and 4 percent of the soil samples collected at IR-23, respectively, and are probably attributable to their ambient concentrations in Artificial Fill material.

Motor oil and waste oil appear to have been released in the northern, southern, and western area around Building 146. Potential constituents of the oil (lead, SVOCs, Aroclor-1260, and 4,4'-DDT) are present in soil within the area of TPH-affected soil.

SVOCs were detected in surface soil on the west side of Building 146 in the location of stained asphalt. SVOCs were also detected on the south side of Building 121. TOG is also present in soil at these locations. The source of SVOCs may be TOG because SVOCs are common constituents of waste oil.

Aroclor-1260 was detected in surface soil (0 to 2 feet bgs) at concentrations exceeding its PRG at the isolated locations north of Building 116 at station PA23SS06, between Buildings 121 and 146 at station PA23SS04, and north of Building 145 at monitoring well IR23MW14A. The source of PCBs at IR-23 may be related to the three transformers formerly located near Building 121.

The pesticide 4,4'-DDT exceeded its PRG in one surface soil sample, sample PA23SS04. The source of 4,4'-DDT in soil at IR-23 is unknown.

TPH-mo was detected at concentrations exceeding the screening criterion in surface soil in borings UT03B015 and UT03B009 west of former Tank S-136 and in boring UT03B009 at the south side of Building 121. The source of TPH-mo near former Tank S-136 may be a surface spill. The source of TPH-mo near Building 121 is unknown.

Bis(2-ethylhexyl)phthalate and TPH-mo concentrations exceeded their screening criteria in groundwater samples collected from wells near Tank S-136. The source of the SVOC and TPH-mo may be attributable to petroleum hydrocarbon-based fuel stored in Tank S-136.

The Navy plans to conduct a removal action to address impacted soil at IR-23. The planned removal action involves excavating soil at each of three exploratory excavation (EE) sites in IR-23, disposing of soil off site, backfilling the excavations, and regrading the sites.

The three EE sites are referred to as EE-01, EE-02, and EE-03. EE-01 is located between the corner of Building 146, the Photograph Development Laboratory, and Building 121. The area of excavation is estimated to measure 7 by 14 feet and to have a minimum depth of 2 feet bgs. The excavation will remove soil containing metals; 4,4'-DDT; and Aroclor-1260 present at concentrations that exceed their PRGs.

EE-02 is located inside the area of former Building 119, which has been demolished. The area of excavation is estimated to measure 25 by 40 feet and to have a minimum depth of 4 feet bgs. The excavation will remove soil containing metals, PAHs, Aroclor-1260, and TPH-mo present at concentrations that exceed PRGs or TPH screening criteria.

EE-03 is located outside the northeast corner of Building 146 and Building 121. The areas of excavation are estimated to measure 27 by 48 feet by 5 feet deep and 50 by 3 feet by 3 feet deep. The excavation will remove soil containing metals and TPHs present at concentrations that exceed PRGs or TPH screening criteria.

Currently, IR-23 is being used by EFA West to store environmental supplies in Building 146. According to the City of San Francisco's proposed reuse plan (see Figure 2-2), IR-23 will be used as a business park and for research and development.

2.3.7 IR-24

IR-24 is a 10-acre, rectangular site in the northern half of HPS immediately east-northeast of IR-10 and adjacent to San Francisco Bay. IR-24 consists of three existing buildings, Buildings 125, 128, and 130, and former Building 124. The areas next to these buildings are asphalt paved.

Before it was demolished, Building 124 formerly housed an acid mixing plant consisting of five wooden ASTs containing sulfuric acid (one tank), distilled water (two tanks), and electrolyte solution (two tanks). The former building was located between Building 123 at IR-10 and Building 134 at IR-25. The tanks were removed before 1988, although documentation of the tank removals is unavailable.

Building 125 formerly housed the Submarine Cafeteria. The building is currently leased to a vinegar-making company and a woodworking shop. A photographer and an artist occupy sections of this building.

Building 128 formerly housed the Shop Service and Work Control Center. Miller Pipeline Company formerly operated two workshops in the southeast portion of Building 128 where oils, solvents, corrosives, and possibly petroleum hydrocarbons were stored. The building is currently used by the San Francisco Police Department to store impounded vehicles. "Contaminated runoff" was reported to have flowed from this building during the fence-to-fence survey conducted at IR-24 in 1988 (ERM West 1988). Two PCB transformers at an electrical substation in the northeast corner of the building were investigated as part of IR-51.

Building 130 was a Shop Service Building. The northern half of Building 130 was formerly occupied by Engel Engineering, and the southern half was used as a paint shop by Protective Finishes Company. Chemicals used in these businesses consisted of oils, paints, methyl ethyl ketone (MEK), toluene, xylenes, and other solvents. Two sumps are located in the southeast corner of the building.

COPCs in soil are arsenic, beryllium, lead, PAHs, and PCBs. Petroleum hydrocarbons were also detected in soil.

Potential sources of contaminants at IR-24 are chemical storage areas and/or sumps located inside Buildings 128 and 130 and transformers, possibly containing PCBs, located north of Building 125 and in the southeast corner of Building 128. Also, soil at IR-24 may be affected by petroleum hydrocarbons that leaked from the fuel distribution lines (IR-46) present at IR-24.

Arsenic, beryllium, chromium, and nickel in shallow soil were detected at concentrations exceeding their PRGs. The presence of these metals may be attributable to their high concentrations in fill materials because, except for arsenic, these metals were not detected at concentrations exceeding their HPALs in soil at IR-24. Arsenic was detected in only one shallow soil sample (PA24B003) collected from a boring southwest of Building 128 at a concentration exceeding its HPAL.

Lead-affected soil is located north of Buildings 128 and 130 and east of Building 130, where the fuel lines are located. The source of lead at IR-24 may be leakage of fuel containing lead from the fuel line system and wastes, including waste paints, generated by the paint shop formerly located in Building 130.

Manganese was detected in soil at concentrations exceeding its PRG in nearly all soil samples and at concentrations exceeding its HPAL in about 25 percent of the soil samples collected at IR-24. Manganese concentrations exceeding its HPAL are located in soil south of Building 128 and to the north and in the eastern portion of Building 130. The source of manganese at IR-24 is unknown.

Chrysene is the only SVOC detected at a concentration exceeding its screening criterion in soil samples collected at IR-24. Chrysene exceeded its PRG in one sample collected from boring PA24MW03A at 2.25 feet bgs at a concentration of 7,800 μg/kg.

Aroclor-1260 was detected in IR-24 soil samples collected in the vicinity of the PCB transformers located north of Building 128.

Soils near the fuel distribution lines contained TPH-d, TPH-g, TRPH, and TOG at concentrations exceeding their screening criteria. Petroleum hydrocarbons are probably associated with releases from the fuel distribution pipelines. Two IR-24 borings contained TPH-d and TOG at concentrations exceeding their screening criteria at least 100 feet from the nearest fuel lines. TPH-d and TPH-mo were commonly detected in IR-24 groundwater samples, along with TPH-g, TOG, and TRPH.

There are no previous or currently planned removal actions at IR-24. According to the City of San Francisco's proposed reuse plan (see Figure 2-2), the northeast and northwest sides of IR-24 will be used as hard surface. The center of IR-24 will be used for future development. The relatively small area of IR-24 that protrudes toward the southwest from the main area of IR-24 will be used for commercial and residential purposes such as retail galleries, artisan studios, artist residences and businesses, warehouses, and hotels.

2.3.8 IR-25

Site IR-25 consists of Building 134, which was used by the Navy for offices, machine shop activities (including parts cleaning) and as the Quality and Reliability Assurance (Q&RA) industrial laboratory. Since base closure in 1974, Building 134 has been used by the Cal Marine Works Machine Shop and, most recently, the Odaco Refrigeration Machine Shop and Storage. These two tenants may have used Building 134 for general storage and marine refrigeration. A large, concrete dip tank and degreasing vat labeled "chlorinated materials" is built into the foundation of the building and drains to a sump that is partly inside and partly outside the building.

Building 134 was inspected in February and March 1991 and in January 1993. Sludge and oily liquid were observed in the dip tank and sump. The contents of the dip tank and sump have been removed, and the dip tank and sump have been cleaned. The floor tile in one machine room was observed to be saturated and deformed by oil and corrosive material. Pools of standing oil on the concrete floor near and under machines were observed in 1991; however, the floors appeared to be clean and in good physical condition in 1993. A utility vault is present outside the southwest side of the building.

Two distinct areas of affected soil and groundwater are located at IR-25. The area in the northwestern portion of IR-25 contains VOCs, SVOCs, pesticides, the PCB Aroclor-1260, and petroleum hydrocarbons at concentrations exceeding screening criteria in soil and groundwater. These contaminants probably result from leakage from a dip tank and sump. A second area of VOC-contaminated soil and groundwater is located in the central portion of IR-25 and is probably the result of (1) leaks from the fuel line that passes beneath this portion of Building 134 and (2) upgradient chlorinated solvents, specifically TCE, from IR-24.

Borings and wells next to and beneath the dip tank contain the maximum concentrations of contaminants detected in soil and groundwater at IR-25. The analytes detected at concentrations exceeding the screening criteria in soil and groundwater are the same as those detected within the dip tank and sump, suggesting that the dip tank and sump are the sources of these contaminants.

Chlorinated solvents (VOCs) and petroleum hydrocarbons (TPH-g and TPH-d) are present in soil in the northwestern portion of IR-25 beneath the dip tank at approximately 8 to 20 feet bgs. Petroleum hydrocarbons are also present in soil about 25 feet south of the dip tank at 1 to 18 feet bgs. The two affected areas are partly commingled near and south of the dip tank.

Metals, VOCs, Aroclor-1260, TPH-g, and TPH-mo are present in shallow soil underlying the central portion of IR-25. Metals, VOCs, SVOCs, pesticides, Aroclor-1260, TPH-g, TPH-d, and probably DNAPL are present in groundwater underlying the northwestern portion of IR-25. TCE and associated compounds are present in groundwater beneath the central portion of IR-25 near the wells in the southeastern portion of Building 134. VOCs, SVOCs, TPH-g, and TPH-d may be present in soil and groundwater beneath and south of the dip tank.

There are no previous or currently planned removal actions at IR-25. Currently, Building 134 is occupied by Odaco, Inc., which uses the building for marine refrigeration. According to the City of San Francisco's proposed reuse plan (see Figure 2-2), IR-25 will be used for commercial and residential purposes such as retail galleries, artisan studios, artist residences and businesses, warehouses, and hotels.

2.3.9 IR-26

IR-26 consists of Building 157, which contained the Navy's Q&RA Industrial Laboratory and the Metal Fabrication Branch, and Area XIV, which consists of Building 140 (pumphouse), Building 141 (dock shipwright's office), and former Building 142A (air raid shelter). Historically, Building 157 was used for welding and fabricating metal products and as a laboratory for the nondestructive testing of metals. The floor in the southern portion of Building 157 is soil or extremely decomposed asphalt. Area XIV and its associated buildings were used as a carpentry shop, drydock, pumphouse, and sandblasting area. Currently, Building 157 and Area XIV are not used.

COPCs in soil are arsenic, chromium, lead, mercury, manganese, PAHs, and PCBs. Petroleum products were also detected in soil at concentrations exceeding screening criteria.

Hazardous substances and petroleum hydrocarbons detected in soils at IR-26 are probably attributable to (1) surface releases of TPH-mo, TCE, and PAHs near Building 157 and (2) surface releases of motor oil, PAHs, and metals in an isolated area south of Building 141. Arsenic, lead, mercury, and manganese were detected in soil at concentrations exceeding their PRGs and HPALs in an isolated area south of Building 141 where petroleum hydrocarbons and associated PAHs were detected in soil at concentrations exceeding their PRGs.

Chromium and petroleum hydrocarbons in soil exceed their screening criteria at the northwest corner of Building 157. The PCB Aroclor-1260 was detected in one surface soil sample at a concentration exceeding its PRG inside Building 157.

The Navy plans to conduct a removal action to address impacted soil at IR-26. The planned removal action involves excavating soil at each of two exploratory excavation sites in IR-26, disposing of soil off site, backfilling the excavations, and regrading the sites.

The two EE sites, EE-04 and EE-05 will remove soil containing arsenic, PAHs, and TPH-mo at concentrations which exceed their PRGs. EE-04 consists of three areas at Building 157, the Nondestructive Metals Testing Lab, in IR-26. The areas of excavation are estimated to be 22 by 26 feet by 7 feet deep; 25 by 35 feet by 2 feet deep; and 15 by 15 feet by 2 feet deep. The excavation will remove soil containing PAHs, PCBs, and TPHs at concentrations exceeding screening criteria. EE-05 is located just south of Building 141, the Dock Shipwrights Office, in IR-26. The estimated area of excavation is 10 feet by 45 feet with a minimum depth of 4 feet bgs.

Currently, there are no tenants at IR-26. Upon completion of all remedial actions for IR-26, the site will be turned over to the City and County of San Francisco for future use (see Figure 2-2). Much of the area will remain paved, especially the shoreline. The west side of IR-26 will be used for future development. The south central area of IR-26 will be used for historical, cultural, or educational purposes.

2.3.10 SI-31

SI-31 is the site of Building 114, an office building demolished sometime between 1990 and 1991. The former building occupies an area of about 100 by 200 feet in the south-central portion of Parcel B.

SI-31 was inspected in February and March 1991. At that time, Building 114 had been demolished and only the footings remained. The former location of Building 114 was covered with what appeared to be sandblast grit. The suspected sandblast grit was removed from SI-31 in 1994, and analytical results of composited, suspected sandblast grit samples indicate that contamination is not present at SI-31.

There are no previous or currently planned removal actions at SI-31. Currently, SI-31 has no tenants. According to the City of San Francisco's proposed reuse plan (see Figure 2-2), SI-31 will be used for commercial and residential purposes such as retail galleries, artisan studios, artist residences and businesses, warehouses, and hotels.

2.3.11 IR-42

Site IR-42 consists of Buildings 109, 113, and 113A, all of which are in the south-central portion of Parcel B. Site IR-42 was investigated during the PA and then evaluated further during the SI conducted in 1993.

Building 109 was used by the Navy as a police station before being occupied by Harbor Sales and Leasing. Information on other past occupants of this building is not available. A buried metal object suspected of being an oil/water mixture reservoir with a capacity of approximately 100 gallons was identified outside Building 109 during the PA; however, geophysical testing did not confirm the existence of a tank.

Building 113 was the Navy's Tug and Submarine Maintenance Shop, Salvage Divers' Shop, and Electrical Substation S. During use by the Navy, Building 113 housed a machine shop, a torpedo maintenance shop, offices, and a transformer for an electrical substation.

COPCs in soil are manganese, nickel, and Aroclor-1260. Petroleum products were also detected in soils.

Oil staining observed inside Building 113 may reflect an isolated occurrence and is not attributable to a UST. Soil around a buried metal object outside Building 109 contained metal at concentrations exceeding their screening criteria; however, the concentrations and distributions of these metals and probably result from fill materials. In addition, geophysical studies could not locate the buried metal object.

Aroclor-1260 was detected in only one soil sample collected from boring PA42B004 at a concentration of 57 μg/kg, which is slightly below its PRG of 66 μg/kg.

There are no previous or currently planned removal actions at IR-42. Building 113 is being used for storage by the City and County of San Francisco Police Department. Building 113A is being used as a quality and reliability assurance nondestructive testing facility by the Smith-Emery Company. According to the City of San Francisco's proposed reuse plan (see Figure 2-2), IR-42 will be used for commercial and residential purposes such as retail galleries, artisan studios, artist residences, and businesses, warehouses, and hotels.

2.3.12 SI-45

Site SI-45 consists of the steam line system that spans all of HPS. The length of the steam line system within Parcel B is approximately 4,000 feet. The steam line system was installed about 40 years ago. The primary function of the steam line system was to provide steam to heat buildings and ships docked at HPS. Portions of the system were used until 1984. The pipes that transported the pressurized steam are contained within concrete vaults referred to as utility corridors (utilidors). Access points are located along the length of the system every 200 to 400 feet. In some areas of HPS, the access points have been paved over.

The steam line system utilidors consist of three types of pipes: (1) steam pipes, which carried pressurized steam and were originally covered with asbestos insulation; (2) condensate return lines, which collected the condensate that formed in the steam lines; and (3) pump return lines, which recirculated the collected condensate back to the main boilers. These pipes are positioned above the utilidor floor by a bracing system.

Between 1976 and 1986, portions of the steam line system may have been used by a tenant of the Navy's to transport waste oils containing PCBs (SFDA 1986). The affected segments of the steam line system may be limited to lines in Parcels C, D, E, and Drydock 4; however, to verify that the steam line system in Parcel B was not used to transport waste oil, an SI of the steam line system was performed in April 1993. The VOCs 1,1-DCE; benzene; TCE; and xylene were detected at concentrations exceeding their screening criteria in a liquid sample collected from the SI-45 steam lines. The petroleum hydrocarbons TPH-g, TPH-d, and TRPH were also detected at concentrations exceeding their screening criteria in the liquid sample. The liquid sample also contained barium at concentrations exceeding its PRG and MCL. The source of these contaminants is unknown; however, they may result from tenant use of steam lines to transport waste oil.

Currently, no portion of the steam line system is in use. The system is proposed to be removed during the remedial action.

2.3.13 IR-46

Site IR-46 consists of the fuel distribution lines at HPS. The portion of IR-46 in Parcel B consists of four pipelines running from the tank farm at IR-06 to the waterfront. The lines were used from 1942 to 1974 to transport diesel fuel to Berths 55 and 56 and to transport both diesel fuel and lubrication oil to Berths 57, 58, and 60, which are at a pier that is currently abandoned. The lines were also used to transport waste diesel fuel and waste lubrication oil from the berths back to the tank farm at IR-06. A diesel fuel and lubrication oil booster pump station located underneath the southeast corner of Building 130 was used to provide the pumplift necessary to bring fuel and oil from the pipelines up to the level of the submarine piers at Berths 55 through 60. An additional diesel fuel line extending from two ASTs at the east corner of Building 146 to the waterfront along Berth 64 at Drydock 7 was identified during the SI.

The clean lubrication oil and waste oil lines measure 3 inches in diameter, and the clean diesel fuel and waste fuel lines measure 4 inches in diameter. HPS maps indicate that the lines running from Berths 57, 58, and 60 were abandoned before 1972. Facility maps also indicate that the lubrication oil lines were abandoned in 1960. The methods of abandonment are not documented. At least one of the lines reportedly contained product in 1992. Pipelines are buried directly in the ground at most locations, and in some limited areas, pipelines are contained within utilidors. Field observations note dark staining around a 4-inch-diameter line at a subsided area at Berth 62.

Contaminants are present in soil and groundwater at fuel lines and tank farm locations within IR-06, IR-24, and IR-25. Petroleum products were also detected in soils.

TPH-d is commonly present in soil and groundwater in the vicinity of the fuel distribution pipelines traversing IR-24. Sources of TPH-d include releases from the diesel and lubrication oil pipelines and waste fuel and oil lines that make up IR-46. TPH-d in soil was detected at concentrations exceeding screening criteria in the following areas along the pipeline: the segment of pipeline in IR-06 where the pipeline system originates, the bend in the pipeline northeast of Building 134, and two pipeline junctions along the IR-24 waterfront where the system branched to supply Berths 55 through 58.

Diesel fuel, lubrication oils, and waste fuels and oils released from the fuel distribution pipelines into vadose zone soils are expected to migrate along pipeline trenches or the bedrock surface where present above the water table. The water table surface apparently has inhibited vertical migration of petroleum hydrocarbons, causing lateral migration downgradient along the water table surface toward San Francisco Bay. The presence of dissolved-phase TPHs in groundwater east of Buildings 128 and 130 to the San Francisco Bay shoreline indicates that off-site migration may also have occurred.

With the exception of lead, metals detected in soil at concentrations exceeding their screening criteria may not be attributable to a release from IR-46. Metals detected in soil at IR-46 may be attributed to their high ambient concentrations in the fill materials. Lead was detected in shallow soil at concentrations exceeding its PRG in soil test pits north, west, and south of Building 134. The source of lead at these locations may be attributable to the leakage of fuel containing lead from the fuel distribution lines. Lead was detected in soil below 40 feet bgs at concentrations exceeding its PRG north of Building 159 and south of Drydock 5 near Berth 61. The source of lead in soil at this location is unknown.

The PCB Aroclor-1260 was detected in soil samples collected in the vicinity of the PCB transformers in Building 128 (see IR-51). Aroclor-1260 was detected in shallow soil (less than 2 feet bgs) at concentrations exceeding its PRG under pipelines in test pits north and west of Building 134 in the same area that lead concentrations exceeded its PRG. The PCBs in this area may be related to sources at IR-06 and/or IR-25, where concentrations of Aroclor-1260 exceeded 100 mg/kg.

Potential sources of SVOCs, TPH-d, and TRPH associated with IR-46 consist of breaches in pipeline system integrity (such as breaks, bends, or loose joints in the pipelines), resulting in releases of diesel fuel, lubrication oils, waste fuels, and/or waste oils. TPH-d and/or TRPH were detected at concentrations exceeding the screening criteria for both petroleum hydrocarbons in over half of the soil sampling locations. Maximum concentrations were detected in test pit samples collected from soil immediately underlying the pipelines. Outside of the test pits, the highest concentrations were detected at or near the water table and were most prevalent in the subsurface area underlying Buildings 128 and 130 and extending to the San Francisco Bay shoreline. TPH-g and SVOCs were detected at concentrations exceeding their screening criteria in soil and commonly in soil samples also containing detectable concentrations of TPH-d and/or TRPH.

TPH-d and/or TPH-mo were detected in nearly all A-aquifer groundwater samples collected at IR-46. TPH-g and TRPH were also detected in IR-46 groundwater samples, although less frequently. These petroleum hydrocarbons delineate an area of affected groundwater extending from the southwest side of Buildings 128 and 130 to the San Francisco Bay shoreline.

Currently, the fuel distribution lines are not in use. The fuel distribution lines are proposed to be excavated and removed during the remedial action.

2.3.14 IR-50

Site IR-50 is the HPS-wide storm drain and sanitary sewer system that traverses numerous sites at Parcel B. The HPS storm drain system was originally part of a combined sanitary sewer and storm drain system constructed from 1942 through 1958. Discharges to the combined sewer system primarily consisted of storm water and domestic sewage, with lesser amounts of industrial wastes including detergents, solvents, plating solutions, thinners, acids, resins, waste oils, and paints. The combined storm drain and sanitary sewer systems for all of HPS originally discharged through 41 outfalls directly to San Francisco Bay.

Separation of the storm drain system from the sanitary sewer system began in 1958 in response to federal Water Pollution Control Act requirements. At that time, drainage in the industrial areas and in the southwestern portion of HPS was separated. Twenty-nine outfalls were converted for storm drain system use exclusively, and 12 outfalls remained for the combined system. In 1973, RWQCB issued an order to the Navy to completely separate the storm drain and sanitary sewer systems and abate current sewage disposal practices. Separation of the storm drain system from the sanitary sewer system was completed between 1973 and 1976.

The storm drain system consists of vitrified clay and concrete pipes, manholes, grated catch basins, and flood control structures. A study of the storm drain system concludes that the following factors may harm the integrity of storm drain lines: (1) locally high flow velocities, (2) the introduction of corrosive organic matter to the storm drain system from former interconnections with the sanitary sewer system, and (3) infiltration of water from San Francisco Bay during high tides.

The storm drain system is driven by gravity flow, and low ground surface elevations and tidal fluctuations inhibit efficient drainage. As a result, sediments carried to the storm drain system during storm events have accumulated in the storm drain lines. Flood-control gates and flap valves are largely inoperative, allowing bay water to enter the system as far as the former 1935 shoreline during high tides. In the northern half of Parcel B, storm drain lines are located below water levels during high tide.

The HPS storm drain system consists of 10 drainage areas, Areas A through J. Portions of three drainage areas, Areas B, C, and D, are within Parcel B. Runoff that collects in Parcel B drains downslope to San Francisco Bay. Storm drain lines in Area B drain the northern and western portions of Parcel B, including runoff from IR-06, IR-07, IR-23, IR-42, IR-60, IR-61, and IR-62. The storm drain system in Area C drains the east-central portion of Parcel B, including runoff from IR-10 and IR-24. The storm drain system in Area C drains the southern portion of Parcel B, including runoff from IR-10, IR-20, IR-24, IR-25, and IR-26. Runoff also enters Parcel B from the northern portions of Parcel A through Areas B and D. From Parcel B, storm drains discharge to San Francisco Bay at three outfalls between Berths 55 and 64, one each for Areas B, C, and D. Two small, unnamed surface drainage areas near Buildings 140 and 142 at IR-26 discharge to the bay near the eastern edge of Parcel B.

The RI results for the storm drain and sanitary sewer systems are discussed separately below.

Storm Drain System

Sandblast grit present in surface and near-surface soils at IR-26 and IR-60 may be the source of lead, copper, and zinc detected in sediment in the storm drain system. Point sources for Aroclor-1260 in near-surface soil at IR-06 and IR-25 probably account for the presence of PCBs in sediment samples collected from the storm drain system.

The maximum concentrations of lead and other metals detected in storm drain system sediment were detected near Building 123 at IR-10, which is a point source for metals. Waste acids and plating solutions were reportedly released of through Building 123 floor drains, which directed the flow into the storm drain system. The maximum concentrations of PAHs in storm drain sediment may be related to the petroleum hydrocarbons present in soil at IR-26, IR-61, and IR-62.

Nonpoint sources probably account for the broad distribution of lead, Aroclor-1260, and TPHs in storm drain system sediment. Nonpoint sources include erosion, transport, and deposition of surface soil that contain these contaminants at concentrations similar to those detected in storm drain system sediment.

The most frequently detected contaminants in storm drain system sediment at concentrations exceeding their PRGs are lead, benzo(b)fluoranthene, benzo(a)anthracene, and Aroclor-1260. Lead in sediment at concentrations exceeding its PRG and HPAL, and Aroclor-1260 in sediment at concentrations exceeding its PRG were detected in the storm drain system. The presence of lead and Aroclor-1260 is partially attributable to a nonpoint source based on average concentrations detected in surface soil samples collected from across Parcel B. Maximum concentrations of lead and Aroclor-1260, however, are probably related to point sources.

TPH-d and TRPH were detected at concentrations exceeding their screening criteria in one sediment sample. The presence of these petroleum hydrocarbons may be attributable to the petroleum hydrocarbon release at IR-06.

The sewer system continues to be used for conveying storm water and sanitary waste and is planned to be used for this purpose in the future. Because sediments in the sewer system contain hazardous substances at concentrations that may pose a risk to the environment and storm drain integrity is poor at several locations, the Navy is currently performing an engineering evaluation and cost analysis (EE/CA) of the storm drain system. The planned removal action involves cleaning out and disposing of sediments in the storm drain system. This removal action is planned for late 1996.

Sanitary Sewer System

Contaminated sediment is present in the sanitary sewer system, primarily in areas of large-diameter pipes. The contaminated sediment appears similar in character to those in the storm drain system, with concentrations of certain metals and Aroclor-1260 exceeding screening criteria.

Leaks in the sanitary sewer system combined with hydraulic gradients from groundwater into the sewer have created a migration pathway from groundwater into the sewer system. This pathway is further indicated by detections of VOCs and TPHs in the sanitary sewer system near sources at IR-25, IR-61, and IR-62.

2.3.15 IR-51

Site IR-51 consists of buildings and other structures throughout HPS, including Parcel B, that formerly housed transformers containing PCBs. In 1988, 199 transformers located throughout HPS were removed for disposal; however, the original locations of many of these transformers were not documented during the removal. Later in 1988, an extensive inventory and investigation of remaining

HPS transformers was conducted that resulted in the identification of 162 transformers at 78 HPS locations. Of the 162 transformers that had not been removed in 1988, 121 were sampled for PCBs. The remaining 41 transformers were not sampled because they were labeled as containing PCB oil at concentrations exceeding 500 mg/L.

As part of a PA conducted in 1989, information was reviewed regarding transformers removed before 1988 and the 162 transformers remaining at HPS. In addition, the status of the 78 transformer locations identified during the 1988 investigation was assessed.

Twelve former transformer locations are present at Parcel B. PCBs were detected in surface soil at concentrations exceeding their PRGs at the former transformer sites, indicating a release to surface soil in the former transformer area between Buildings 125 and 159 and in the western corner of Building 128 at IR-24.

There are no previous or currently planned CERCLA removal actions at IR-51.

2.3.16 IR-60

Site IR-60 consists of Dry Docks 5, 6, and 7, which are open docking areas surrounded by piers. Rail lines for cranes extend along the piers, and multiple utility lines, underground corridors, and vaults open into each dock area. Each dock area measures about 420 by 60 feet and is 33 feet deep, and each area has reinforced concrete sides. All areas are also assumed to have concrete bottoms. The piers each measure 420 by 50 feet and are constructed of concrete and wood.

Dry Docks 5, 6, and 7 were active until about 1974. Ships were floated into the docks for repairs, sea gates were closed, and water was pumped out. After repairs were completed, the docks were reflooded and the ships floated out. Site activities conducted at IR-60 also included sandblasting and painting ships.

COPCs in soil are arsenic, manganese, thallium, zinc, and PAHs. Except for lead, metals detected in soil at concentrations exceeding their screening criteria do not indicate a release because of the isolated distribution of the detections and the low frequency of screening criteria exceedances. Petroleum hydrocarbons were detected in shallow soil at concentrations exceeding their screening criteria along the shoreline near Dry Docks 5 and 6. The concentrations and distributions of metals detected in groundwater at IR-60 are similar to those throughout Parcel B and therefore probably represent ambient conditions. Lead was detected in soil at concentrations exceeding its screening criterion near Dry Dock 7; however, it is not a COPC based on the HHRA. The source of lead in soil at these locations may be ship painting activities.

SVOCs detected at concentrations exceeding their PRGs are benzo(a)pyrene and benzo(b)fluoranthene in soil samples collected from borings IR60B001 and IR60B002, respectively. The source of these SVOCs at these two locations is unknown.

TPH-mo was detected in groundwater at concentrations exceeding its screening criterion in A-aquifer wells near Dry Docks 6 and 7. The source of petroleum hydrocarbons in groundwater is unknown.

There are no previous or currently planned removal actions at IR-60. Currently, IR-60 has no tenants. According to the City of San Francisco's proposed reuse plan (see Figure 2-2), IR-60 will be used as hard surface.

2.3.17 IR-61

IR-61 was used as an electric power generating substation (Electrical Substation V). IR-61 consists of a two-story building, Building 122, with two one-story add-on buildings and a basement. The two-story portion houses four platforms that previously held two generators. Drain pipes and sumps that contained oils and other fluids are located near the platforms. The larger one-story add-on building contains switches, and the small add-on building encloses a sump. Outside and east of the two-story building is an uncurbed pad that held three transformers.

COPCs in soil are arsenic, barium, and PCBs. Petroleum products were also detected in soil at concentrations exceeding screening criteria. Arsenic and barium exceeded their HPALs in only 2 and 7 percent of the samples collected at IR-61, respectively, and are probably attributable to their ambient concentrations in Artificial Fill material.

Petroleum hydrocarbons and the PCB Aroclor-1260 were detected in soil samples at concentrations exceeding their screening criteria. Except for TRPH, petroleum hydrocarbon concentrations in soil are below the screening criterion. TRPH was detected in a few soil samples at concentrations exceeding its screening criterion. Aroclor-1260 was detected in surface and shallow soil at concentrations exceeding its screening criterion in two soil samples collected in an area just northwest of Building 122.

The source of PCBs and petroleum hydrocarbons in soil at IR-61 is probably a transformer release of petroleum hydrocarbon-based dielectric fluids that may have contained PCBs. The two generators formerly operated at IR-61 may have released petroleum hydrocarbon-based lubricating fluids and could therefore be the sources of the petroleum hydrocarbons.

Manganese, nickel, and thallium were detected at concentrations exceeding their screening criteria in groundwater samples collected from the two monitoring wells at IR-61. The screening criteria exceedances of manganese and thallium may be attributed to their ambient concentrations in Artificial Fill material. Thallium was detected at concentrations only slightly exceeding its NAWQC and does not appear to be specifically related to a potential contaminant source.

TPH-mo was detected at concentrations exceeding its screening criterion of 100 μg/L in groundwater samples collected from the two monitoring wells at IR-61. The source of TPH-mo in groundwater may be surface spills or leakage of petroleum hydrocarbon-based lubricating fluid used in the generators that formerly operated at IR-61.

There are no previous or currently planned removal actions at IR-61. Currently, IR-61 (specifically Building 122) is being used as an electrical substation by EFA West. According to the City of San Francisco's proposed reuse plan (see Figure 2-2), IR-61 will be used as a business park and for research and development.

2.3.18 IR-62

Site IR-62 consists of Buildings 115 and 116 and UST S-135 (also referred to as UST-2), which is located northwest of Building 116. Building 115 is a two-story, wood frame building with asbestos shingle siding that contained shop areas and classrooms for training. Building 115 also was previously used for training. A large blower-like machine adjacent to a concrete sump contains a 500-gallon steel storage tank in the southwestern part of the first floor. A transformer shed is located at the northeast corner of the building. Building 115 shares the truck dock on its north side with Building 116. In

February 1994, Building 115 was being leased to New World Design, a home-building and cabinetry company.

Building 116 is a one-story building attached to Building 115. A large open area approximately 200 feet long and 30 feet wide and divided into several sections is located in the western portion of Building 116. Four drains in the concrete floor are located in this area. The eastern portion of Building 116 was the former location of a machine shop, a separate open shop, and a truck dock on the north side. A manhole drains the truck dock area, and a furnace room opens out onto the truck dock. The building has a two-room, rectangular addition, with a floor drain in each room, on the south side of this portion of the building. Building 116 may have been used for training and as a reserve center. Hydraulic equipment was used at the training school, which had a machine shop with a transformer substation (Building 115).

Metals were detected in soil at concentrations exceeding their PRGs and HPALs; however, the chromium and nickel exceedances in soil at IR-62 probably result from the serpentinite bedrock and bedrock-derived fill. Metals detected at IR-62 are not COPCs based on the HHRA. TPH-g, TPH-d, and TRPH were detected in soil near Tank S-135 at concentrations exceeding their screening criteria and may be attributable to leaks from the former UST and its associated piping system.

Metals in groundwater in A-aquifer wells were detected at concentrations exceeding their screening criteria and are probably not attributable to a release but to ambient levels. TPH-g, TPH-d, and TRPH were detected in groundwater in the vicinity of the Tank S-135 site at concentrations exceeding their screening criteria. These petroleum hydrocarbons may be attributable to leaks from the former UST and associated piping system.

Currently, IR-62 has three tenants. Finish Works uses Building 115 for cabinetmaking and storage and Building 116 for picture framing; J. Terzian uses Building 117 for art activities; and the Police Athletic Club uses Building 120 for an athletic facility. According to the City of San Francisco's proposed reuse plan (see Figure 2-2), IR-62 will be used for commercial and residential purposes such as retail galleries, artisan studios, artist residences and businesses, warehouses, and hotels.

2.4 REMOVAL ACTIONS

This section discusses the completed and proposed removal actions at Parcel B. Completed removal actions involve sandblast grit fixation removal, the IR-06 tank farm removal, and facility-wide UST and aboveground storage tank (AST) removals.

In 1993, an evaluation of HPS was conducted to determine acceleration opportunities for the HPS BRAC Closure Plan. This evaluation identified 11 potential removal actions. Of these 11 actions, the following four removal actions were designated as high-priority activities by the Navy and regulatory agencies: (1) the exploratory excavation removal action; (2) storm drain system sediment removal action; (3) a groundwater removal action in Parcels B, C, D, and E; and (4) the removal of floating product at IR-03 in Parcel E. Of these four removal actions, five exploratory excavation soil removal sites, a storm drain system sediment removal, and groundwater removal actions are identified for Parcel B. The floating product removal at IR-03 in Parcel E does not apply to Parcel B. Currently, EE/CAs are underway for each of these four removal actions. Technical memoranda for the removal actions are presented in Appendix G. The Parcel B removal actions are discussed below.

2.4.1 Sandblast Grit Fixation Removal Action

Sandblast operations generating grit that may have contained paint chips, heavy metals, and oil were conducted at numerous locations at HPS including Parcel B. Between 1991 and 1995, 4,665 tons of sandblast grit was collected and consolidated in Parcel E. In addition, about 245 tons of sandblast grit was collected from eight small piles around HPS. Three of these piles were located in Parcel B. About 20 tons of grit was collected at IR-26 west of Building 140, 30 tons was collected at IR-31, and 2 tons was collected northeast of IR-20 (Battelle 1996). The grit was sent to an asphalt plant, where it was recycled for use in the manufacture of asphalt for roads. This removal action was completed in 1995.

2.4.2 IR-06 Tank Farm Removal Action

The purpose of the IR-06 Tank Farm removal action was to remove the ASTs and associated piping. This removal action did not include soil remediation; however, soil remediation is currently planned under a separate removal action at IR-06 (see Section 2.3.7). The IR-06 Tank Farm was constructed in

1942 as a diesel fuel and lubrication oil storage and distribution facility. The tank farm operated from the early 1940's until 1976, at which time it was used by Triple A. The tank farm consisted of 10 aboveground fuel and lubrication oil tanks, piping, two pumphouses, and associated equipment. The storage tanks were located in four separate bermed areas: Area 1 contained concrete support racks for eight previously removed horizontal lubrication oil tanks; Area 2 contained a 12,000-gallon vertical tank located directly on the ground surface; Area 3 contained eight vertical 12,000-gallon tanks, each supported by four concrete tank support piers; and Area 4 contained one 210,000-gallon, flat-bottomed tank also located directly on the ground surface. One of the pumphouses was located between Areas 1 and 2, and the second pumphouse was located between Areas 3 and 4 (HLA 1992e).

The IR-06 Tank Farm removal action was conducted in 1993 and included the following activities: (1) removal of asbestos-containing material (ACM) from piping, pumps, and tanks; (2) removal of petroleum fuel and solvents remaining in the tanks, pipes, and the Building 112 sump; (3) removal of tanks and piping; (4) removal of concrete foundations for the vertical and horizontal tanks; (5) demolition of the two pumphouses (Buildings 111 and 112); (6) installation of new catch basins; and (7) grading and capping of the areas with a high-density polypropylene (HDPP) liner. An HDPP liner was installed instead of the clay cap specified in the removal plans because, at that time, remediation of the soil at the tank farm was expected to occur within the next few years. Soil remediation is currently being addressed under a separate removal action (see Section 2.3.7).

All tanks, piping, and steel at the tank farm were decontaminated and salvaged. Tank and pipe contents and rinsate water were recycled or treated. Approximately 7 cubic yards (yd^3) of friable asbestos and 10 yd^3 of nonfriable asbestos was generated and landfilled during the removal action. The friable asbestos was disposed of at the California Asbestos Monofil, in Copperopolis, California; and the nonfriable asbestos was disposed of at Redwood Landfill, a Class III landfill in Novato, California. Approximately 140 yd^3 of soil was excavated to remove underground piping. This soil contained metals at concentrations exceeding the total threshold limit concentrations (TTLC) and was disposed of as hazardous waste in a Class I landfill along with used personal protective equipment worn by removal action field workers. Additionally, approximately 140 yd^3 of vegetation, concrete, and building debris were disposed of at a Class III landfill. All storm drain lines and other underground piping outside the berms remain in place. Sumps were cleaned and backfilled with soil.

A layer of floating petroleum produce was detected on the groundwater during the installation of a new catch basin in Area 3. Visible petroleum staining was observed in the catch basin and pipe removal excavations. In Areas 1, 2, and 4, the visible staining extended to a depth of approximately 3 to 4 feet below ground surface (bgs). In Area 3, the visible staining extended to a depth of approximately 8 feet bgs.

2.4.3 UST and AST Removal Actions

The Navy has removed or closed in place a total of 46 USTs at HPS. USTs at HPS were removed or closed in place during Phase I in 1991 and Phase II in 1993. Thirty-six USTs have been removed and 10 have been closed in place under the IRP. Of these 46 USTs, only two were located in Parcel B. Both of these USTs (Tanks S-135 and S-136) were removed in 1993 during Phase II of the UST removals (PRC 1994c).

One-hundred ASTs have been identified at HPS, and 28 were located in Parcel B. Twenty-five of these tanks have been removed. The location, capacity, contents, and status of each AST and UST at Parcel B are summarized in the table below.

Tank Location	Number of Tanks	Capacity (Type) (gallons)	Contents	Status
IR-62, Tank S-135	1	1,250 (UST)	Fuel oil	Removed
IR-23, Tank S-136	1	750 (UST)	Fuel oil	Removed
IR-62, Building 115	1	100 (AST)	Unknown	To be evaluated
IR-24, Former Building 124	5	Two 7,500 (ASTs)	Sulphuric acid	Removed
		Two 5,000 (ASTs)	Electrolytes	
		5,000 (AST)	Distilled water	
IR-23, Building 146	2	Unknown (AST)	Petroleum hydrocarbons	Removed
IR-06, Tank Farm	1	12,000 (AST)	Lubrication oil	Removed
IR-06, Tank Farm	2	Two 12,000 (ASTs)	Stoddard solvent	Removed
IR-06, Tank Farm	8	3,000 (AST)	Lubrication oil	Removed
IR-06, Tank Farm	7	210,000 (AST)	Diesel fuel	Removed
		Six 12,012 (AST)		

The HPS Caretaker Site Office (CSO) was contacted to request information on any tank removals or removal actions conducted by the CSO (PRC 1996). The CSO's response indicated that no documentation of tank removals conducted by the CSO exist. The information request letter and CSO response are included in Attachment G-D of Appendix G.

2.4.4 Exploratory Excavation Removal Actions

The purpose of the exploratory excavation removal action is to remove hazardous substances in soil at exploratory excavation sites that pose a threat to human health and the environment. During the Parcel B, C, D, and E site investigations, 28 areas of stained soil, asphalt, and concrete were identified. Eighteen of these sites meet the criteria for a CERCLA removal action and are within the exploratory excavation scope. Surface soil and soil boring data for most locations show elevated concentrations of semivolatile organic compounds (SVOC), metals, PCBs, or total petroleum hydrocarbons (TPH). The removal action is planned for the summer of 1996.

The Navy conducted an EE/CA to evaluate the alternatives for addressing hazardous substance-impacted soil. Based on the EE/CA evaluation, the recommended alternative involves excavating impacted soil at each of the 18 exploratory excavation sites, disposing of impacted soil at an off-site landfill, backfilling the excavations, and regrading the sites. Five of the exploratory excavation sites are located in Parcel B: EE-01, EE-02, and EE-03 are located in IR-23 and EE-04 and EE-05 are located in IR-26 (PRC 1996).

At EE-01, 7 yd^3 of soil are planned to be excavated. The excavation will remove soil containing elevated concentrations of metals; 4,4'-dichlorodiphenyltrichloroethane (4,4'-DDT); and Aroclor-1260 that exceed their U.S. EPA preliminary remedial goals (PRG) for residential soil. Based on the HHRA, the excavation will reduce or eliminate carcinogenic risk resulting from exposure to concentrations of arsenic; 4,4'-DDT; 4,4'-dichlorodiphenyldichloroethane (4,4'-DDD); 4,4'-dichlorodiphenyldichloroethane (4,4'-DDE); tetrachloroethene (PCE); and polynuclear aromatic hydrocarbons (PAH). Also, the excavation will reduce or eliminate noncarcinogenic risk from exposure to metals and 4,4'-DDT.

At EE-02, 148 yd^3 of soil are planned to be excavated. The excavation will remove soil containing elevated concentrations of metals, PAHs, Aroclor-1260, and TPH as motor oil (TPH-mo) that exceed their PRGs, HPALs, or the TPH-mo screening level of 1,000 mg/kg. Based on the HHRA, the excavation will reduce or eliminate carcinogenic risk resulting from exposure to concentrations of PAHs and Aroclor-1260. The excavation will also reduce noncarcinogenic risk resulting from exposure to vanadium concentrations.

At EE-03, approximately 257 yd^3 of soil are planned to be excavated. The excavation will remove soil containing concentrations of metals and TPHs that exceed their PRGs or the TPH screening levels of 1,000 mg/kg for TPH-d, TPH-mo, TRPH, and TOG; and 100 mg/kg for TPH-g. Based on the HHRA, the excavation will reduce or eliminate carcinogenic and noncarcinogenic risks resulting from exposure to metal concentrations.

At EE-04, approximately 362 yd^3 of soil are planned to be excavated. The excavation will remove soil containing concentrations of PAHs, Aroclor-1260, and TPHs that exceed their PRGs or the TPH screening levels of 1,000 mg/kg for TPH-d, TPH-mo, TRPH, and TOG; and 100 mg/kg for TPH-g. Based on the HHRA, the excavation will reduce or eliminate carcinogenic risk resulting from exposure to concentrations of trichloroethene (TCE), PCE, PAHs, and Aroclor-1260. Also, the excavation will reduce or eliminated noncarcinogenic risk resulting from exposure to zinc concentrations.

At EE-05, 67 yd^3 of soil are planned to be excavated. The excavation will remove soil containing concentrations of arsenic, beryllium, PAHs, and TPH-mo that exceed their PRGs or the TPH-mo screening level of 1,000 mg/kg. Based on the HHRA, the excavation will reduce or eliminate carcinogenic and noncarcinogenic risks resulting from exposure to concentrations of metals and PAHs. Also, the excavation will reduce or eliminate carcinogenic risk resulting from exposure to PAH concentrations.

2.4.5 Storm Drain System Sediment Removal Action

SI results indicate that (1) storm drain sediments in Parcels B, C, D, and E contain hazardous substances at concentrations that may pose a risk to the environment and (2) storm drain integrity is poor in several locations. The Navy is currently performing an EE/CA of the storm drain system. The planned removal action involves cleaning out and disposing of sediments from the storm drain system. This removal action is planned for late 1996.

2.4.6 Groundwater Removal Action

Groundwater below Parcel B generally flows toward San Francisco Bay. Groundwater containing high concentrations of solvents has been detected below Parcel B at IR-24 and IR-25, and groundwater containing hexavalent chromium (chromium VI) has been detected below IR-10.

The Navy conducted an EE/CA to evaluate alternatives for addressing source control and contaminated groundwater at Parcel B; however, because the removal action will not begin before submittal of the Parcel B FS report in June 1996, further work on the removal action has ceased. Instead, information from screening groundwater data for all of Parcel B performed as part of the EE/CA effort will be incorporated into the Parcel B FS report. Thus, a cohesive and comprehensive approach for IR-24, IR-25, and IR-10 groundwater will be presented in the FS report.

2.4.7 IR-06 Tank Farm Soil Removal Action

The purpose of the IR-06 Tank Farm soil removal action is to reduce or remove hazardous substances in vadose zone soils. The IR-06 Tank Farm was used by the Navy as a fuel and lubrication oil storage and distribution facility from the early 1940s until 1976, when it was used by Triple. Section 2.3.2 describes the IR-06 Tank Farm removal action conducted in 1993. Substances identified in the soil during the 1993 removal action include lead, PCBs, carcinogenic PAHs, and TPHs.

The Navy conducted an EE/CA to evaluate alternatives for soil remediation at the IR-06 Tank Farm. Based on the EE/CA evaluation, excavation and disposal of hazardous substance-impacted (lead, PCB, and PAH) soil is the recommended removal action alternative. TPH-impacted soil will be bioremediated on site. The removal action is scheduled to begin in late 1996.

2.5 RISK ASSESSMENT SUMMARY

Analytical results from the field investigation were used to evaluate potential risks and hazards to human health. Future residential receptors may be exposed to hazardous substances in soil through ingestion of and dermal contact with this soil and through ingestion of produce grown in the soil. Future workers may be exposed to hazardous substances in soil through ingestion of and dermal contact with this soil and inhalation of volatile emissions and particles in air from the soil. The RWQCB has indicated that the A-aquifer is unlikely to be used as a potable drinking water source in the future; therefore, the A-aquifer was not evaluated in the HHRA for drinking water purposes or for household use. Future residents and workers may be exposed to VOCs in the A-aquifer through inhalation of VOCs volatilizing in groundwater, through soil, and into buildings through cracks in the walls and foundations.

Appendix B presents the methodology used during the HHRA and summarizes the excess lifetime cancer risk (ELCR) and hazard index (HI) for residents and workers under the future residential and industrial land use scenarios, respectively.

2.6 POTENTIAL RI DATA GAPS, PLANNED ADDITIONAL INVESTIGATIONS, AND PLANNED MITIGATIVE MEASURES

Several parcel-wide and IR-specific data gaps were identified in the draft-final RI report. Investigation of some of the data gaps, such as the extent that the fuel lines, steam lines, and storm sewers impact contaminant migration, may require significant time and cost and still only provide inconclusive results. Some data gaps, such as determining the extent of contamination at some locations, are anticipated to have little impact on the FS. Other data gaps can be addressed during predesign activities. The Navy proposes to address data gaps in the following manner:

1. Prepare the FS report using the information available from the RI report
2. Propose measures designed to (1) mitigate potential hazardous substance migration along preferred pathways such as utility and fuel lines and storm sewers and (2) remove contaminated soil in close contact with the fuel lines
3. Prepare a proposed plan based on RI and FS findings
4. Conduct predesign activities, including additional delineation of contamination at certain sites and treatability studies, as needed
5. Reassess the selected remedial alternatives for soil and groundwater if the newly acquired information indicates that the selected alternative may not meet the RAOs for protecting human health and the environment or if the volume of contaminated media is substantially higher than estimated in the FS report

Table 2-6 lists the data gaps identified during the RI, impacts of the data gaps on the FS, and planned additional investigations and presumptive mitigative measures.

The Navy proposes to conduct the following four primary mitigative measures during removal and remedial actions at Parcel B:

- Removal of DNAPLs at IR-25 by excavation of soil containing DNAPLs and pumping underlying DNAPL and groundwater mixture from the excavation
- Lining of storm drains below the water table and pressure grouting of bedding material surrounding the storm drains
- Removal and disposal of steam lines from utilidors
- Removal and disposal of fuel lines and visually contaminated soil

Each of these mitigative measures is discussed below.

2.6.1 Removal of DNAPLs at IR-25

To prevent continued dissolution to groundwater of contaminants in the DNAPL source at IR-25 and to mitigate potential exposure to VOC vapors, the Navy proposes to excavate soil containing DNAPLs and to pump underlying DNAPL/groundwater mixture from of the excavation. The exact location and extent of the DNAPL area has not been identified but is suspected to be located beneath the existing sump in Building 134. Because the DNAPL source is believed to be located beneath the sump, the sump would be demolished and hauled off site to a landfill and the underlying soil excavated. The sump was previously cleaned out and is therefore assumed to be uncontaminated. Sheet piling and bracing would be installed along all four of the sump excavation walls to provide temporary shoring during soil excavation. In addition, underpinning would be installed to support the building and its structural members.

DNAPLs are denser than water and tend to sink rather than migrate laterally. Lateral migration usually occurs as a result of the lithology of the aquifer. Groundwater analytical data indicate that the DNAPLs are located at approximately 20 feet under the sump. Soil would therefore be removed directly from beneath the sump to a depth of approximately 20 feet below the sump bottom to remove DNAPLs. Excavated soil contaminated with DNAPLs would be treated in accordance with the selected soil remedial alternative. Also, any DNAPL/groundwater mixture from beneath the sump would be transported off site for treatment and disposal at a licensed or permitted facility. The excavated area would be backfilled with clean soil, compacted, and covered with a reinforced concrete slab.

Removal of DNAPLs at IR-25 will be included in the development of groundwater alternatives described in Section 4.3; however, management of soil below the sump at IR-25 which may contain DNAPLs is included in the development of soil alternatives described in Section 4.2.

2.6.2 Lining of Storm Drains and Pressure Grouting of Bedding Material

The Navy has conducted an infiltration study (Draft EE/CA for Storm Drain System, Appendix A, April 5, 1996) to evaluate the movement of contaminated groundwater into the storm drain system. This infiltration study identified several sections of the storm drain system that have the potential to be infiltrated by contaminated groundwater.

Several sections of storm drain are located below the contaminated groundwater table at IR-07, IR-10, and IR-25. These storm drain sections consist of approximately 450 feet of 18-, 36-, and 39-inch-diameter pipes at IR-07; 100 feet of 12-inch-diameter pipe at IR-10; and approximately 600 feet of 30- and 33-inch-diameter pipes at IR-25. These sections of the drain system may allow infiltration of contaminated groundwater. Because these drains may be a direct pathway for contaminated groundwater to enter San Francisco Bay, the FS will assume that they will be lined to prevent infiltration of contaminated groundwater and the pipe bedding material will be isolated from contaminated groundwater through pressure grouting. The actual storm drain lines to be lined will be identified in a follow-up infiltration study as part of the storm drain sediment removal action.

Lining of storm drains and pressure grouting of bedding material will be included in the development of groundwater alternatives described in Section 4.3.

2.6.3 Removal and Disposal of Steam Lines

Analyses of water samples from the steam lines at Parcel B collected during the RI indicate that water in the steam lines may contain low concentrations of VOCs and TPHs. The source of the contaminants may be from oils suspected to have been transported through the steam lines.

The length of the steam line system within Parcel B is approximately 4,000 feet. The steam lines are no longer in service. As a mitigative measure to prevent releases to soil or groundwater and to prevent potential future exposure to contaminants that may be in the steam lines, the Navy proposes to remove and dispose of the lines. Pipes that transported pressurized steam are contained within concrete vaults referred to as "utilidors." The steam line system utilidors contained three types of pipes: (1) steam pipes, which carried pressurized steam and were originally covered with asbestos insulation; (2) condensate return lines, which collected condensate that formed in the steam lines; and (3) pump return lines, which recirculated the collected condensate back to the main boilers. These pipes are positioned above the utilidor floor by a bracing system. The pipes will be pulled through access points located along the length of the system every 200 to 400 feet. In some areas, the access points have been paved over. The pipes will be emptied, rinsed, and sold as scrap metal or disposed of off site.

Removal and disposal of steam lines will be included in the development of groundwater alternatives described in Section 4.3.

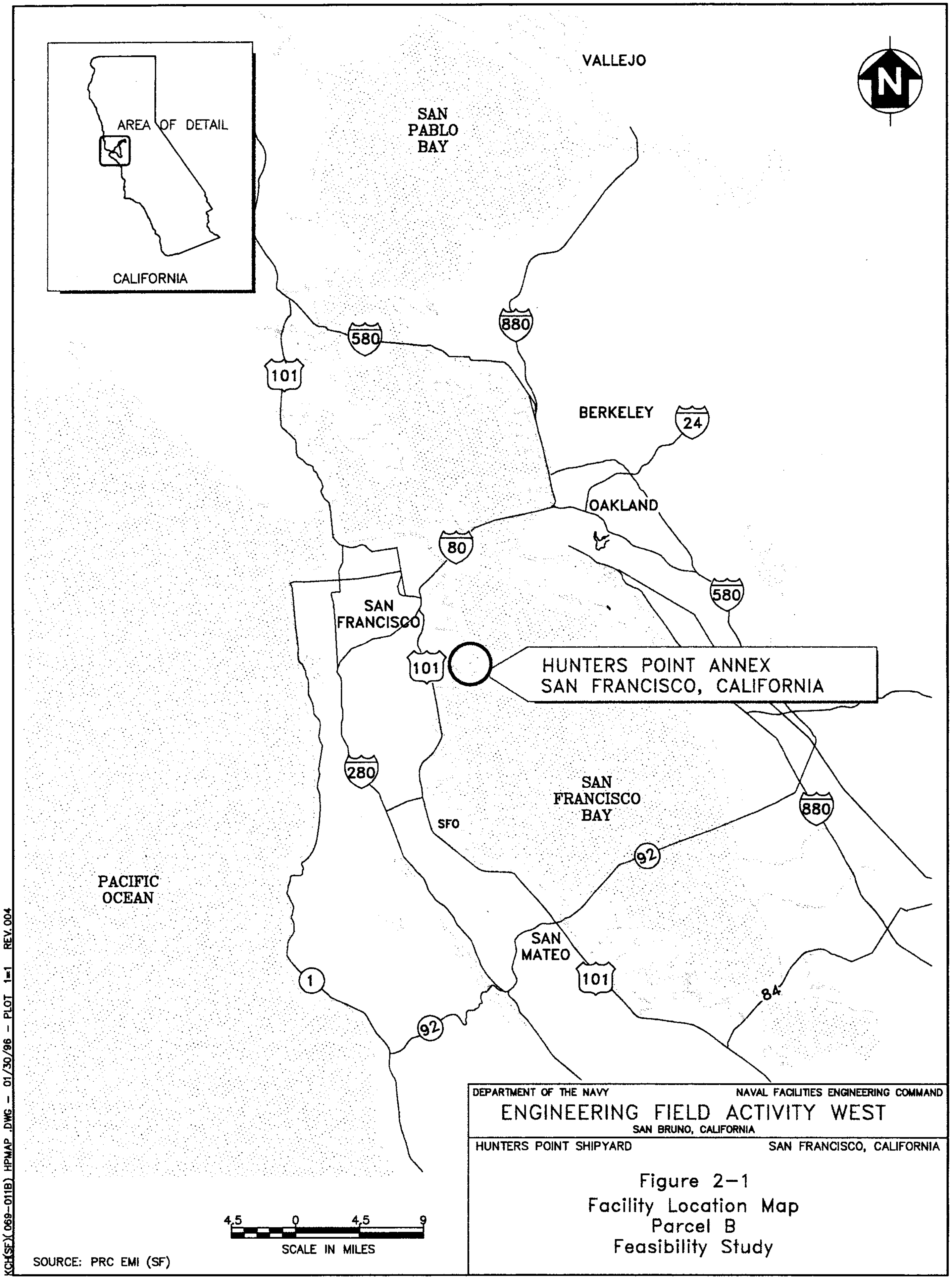
2.6.4 Removal and Disposal of Fuel Lines and Contaminated Soil

The Navy proposes to remove the fuel distribution lines at Parcel B. Four pipelines are located within Parcel B running from the tank farm at IR-06 to the waterfront. The lines were used from 1942 to 1974 to transport diesel fuel to Berths 55 and 56 and to transport both diesel fuel and lubrication oil to Berths 57, 58, and 60, which are located at a currently abandoned pier. The lines were also used to transport waste diesel fuel and waste lubrication oil from the berths to the tank farm at IR-06. A diesel fuel and lubrication oil booster pump station located underneath the southeast corner of Building 130 was used to provide the pumping necessary to bring fuel and oil from the pipelines up to the level of the submarine piers at Berths 55 through 60.

The clean lubrication oil and waste oil lines measure 3 inches in diameter, and the clean diesel fuel and waste fuel lines measure 4 inches in diameter. HPS maps indicate that the lines running from Berths 57, 58, and 60 were abandoned before 1972. Facility maps also indicate that the lubrication oil lines were abandoned in 1960. The methods of abandonment are not documented. At least one of the lines reportedly contained product in 1992. Pipelines are buried directly in the ground at most locations, and in some limited areas, pipelines are contained within utilidors. Field observations note dark staining around a 4-inch-diameter line at a subsided area at Berth 62.

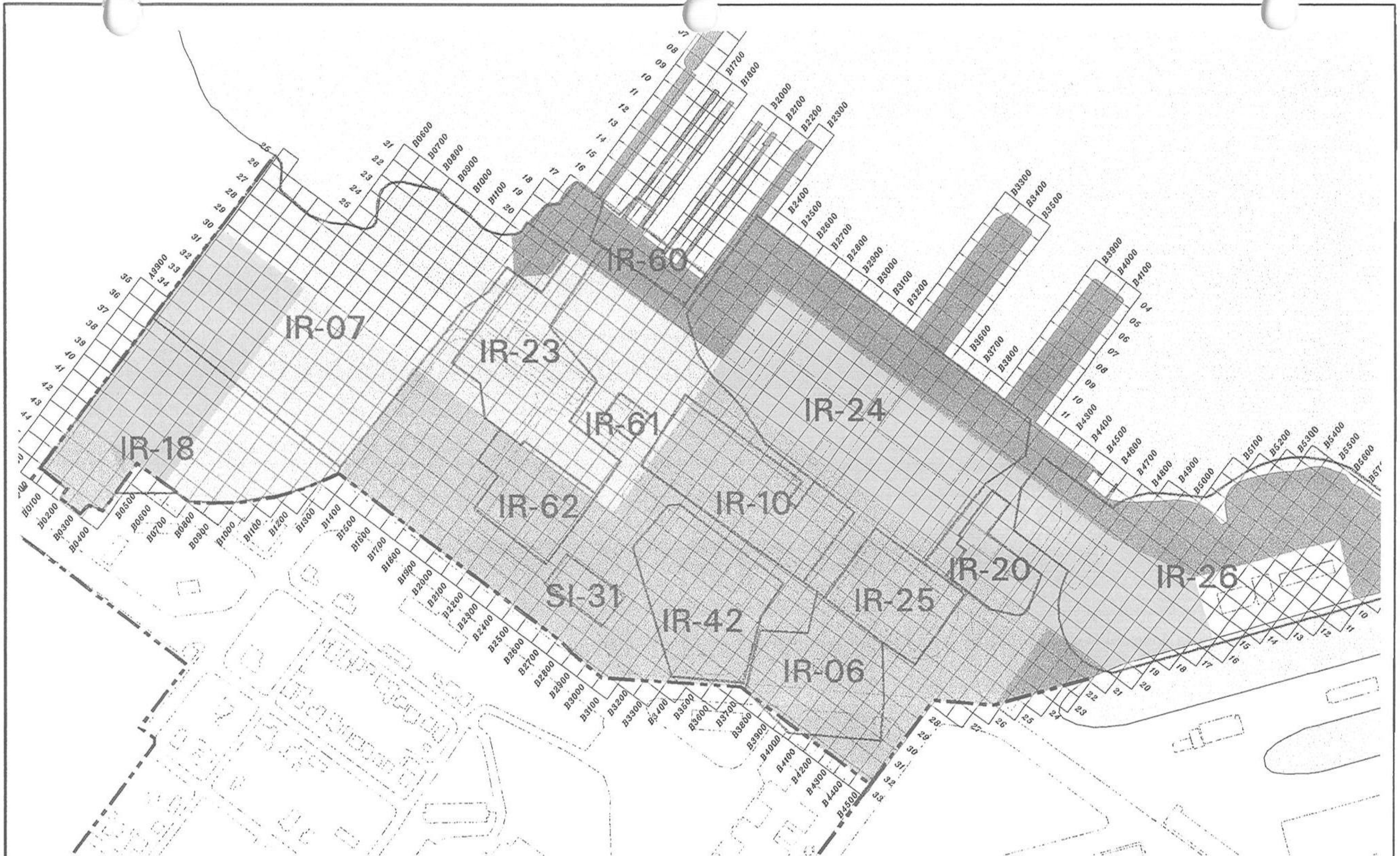
Excavated pipelines will be emptied, rinsed, and disposed of off site. Stained soil encountered during removal of the fuel distribution lines will be excavated and treated in accordance with the soil alternative selected (if CERCLA hazardous substances are detected above cleanup standards in the soil) or with the petroleum corrective action plan. Confirmatory soil samples will be collected and analyzed in accordance with the approved remedial design to ensure that RAOs are met in the area of the fuel distribution lines. Removal of the fuel lines and stained soil will be coordinated with the petroleum corrective action plan.

Removal of the fuel lines will be included in the development of groundwater alternatives described in Section 4.3, and management of visually contaminated soil below the fuel lines that contain hazardous substances exceeding cleanup goals is included in the development of soil alternatives described in Section 4.2.



DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
ENGINEERING FIELD ACTIVITY WEST
SAN BRUNO, CALIFORNIA
HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA

Figure 2–1
Facility Location Map
Parcel B
Feasibility Study



EXPLANATION (2,500-SQUARE FOOT EXPOSURE AREAS)

- PARCEL B BOUNDARY
- EXTENDED SITE BOUNDARY
- Open Space
- Future Development
- Business Park/Research & Development
- Mixed Use: Retail/Gallery, Artisan Studio, Hotel/Conference
- Educational/Cultural/Historical
- Hard Surface
- Proposed Wetland Restoration

N

175 0 175 350
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL ACTIVITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

FIGURE 2-2
PARCEL B
DRAFT REUSE PLAN
APRIL 24, 1995

/data0/hunters/amls/parc_b/reuse_596.gra Code: /data0/hunters/amls/parc_b/draftreuse.aml DKV

05/31/96

EXPLANATION:

LOCATION OF EXISTING BUILDING

LOCATION OF FORMER BUILDING

1935 SHORELINE

PREVIOUS DOCK LOCATION

PARCEL BOUNDARY

FENCE

RAILROAD TRACK

GEOLOGIC DESCRIPTIONS

SURFICIAL DEPOSITS

Qls LANDSLIDE DEBRIS ZONE AND DIRECTION OF MOVEMENT

Qaf FILL MATERIALS; INCLUDES MATERIALS FROM LOCAL CUT/FILL GRADING AND DISPOSAL OF REFUSE AND SANDBLAST WASTE

Qsr SLOPE AND RAVINE DEPOSITS; MAY HAVE BEEN REMOVED IN SOME AREAS BY PREVIOUS GRADING OPERATIONS

FRANCISCAN COMPLEX BEDROCK

KJs SANDSTONE AND SHALE, UNDIFFERENTIATED; MAY INCLUDE OTHER ROCK TYPES

KJc CHERT, INTERBEDDED WITH SHALE

KJg *GREENSTONE (ALTERED) VOLCANIC ROCK, PREDOMINANTLY BASALT*

sp SERPENTINITE, CONTAINS SMALL BODIES OF UNSERPENTINIZED ULTRAMAFIC ROCK

SYMBOLS

?· *CONTACT BETWEEN GEOLOGIC UNITS, DASHED WHERE APPROXIMATE, DOTS WHERE BURIED, QUERIED WHERE UNCERTAIN*

35 STRIKE AND DIP OF SHEAR FOLIATION

ACTIVE SPRING (7/93)

AREA OF SUSPECTED SEEPAGE (7/93)

GROUND SURFACE ELEVATION CONTOUR (FEET MSL) (CONTOUR INTERVAL = 2 FEET)

GROUND SURFACE ELEVATION CONTOUR (FEET MSL) (CONTOUR INTERVAL = 10 FEET)

NOTES:

(1) *TOPOGRAPHIC BASE REFERENCE: HUNTERS POINT NAVAL SHIPYARD,* TOPOGRAPHIC/BASE MAP; NAVEL FACILITIES, ENGINEERING COMMAND, WESTERN DIVISION, DRAWING No. C-104254 (12 sheets), DECEMBER 1986

(2) GEOLOGY MODIFIED FROM BONILLA, M.G., 1971, U.S. GEOLOGICAL SURVEY, MISCELLANEOUS FIELD STUDIES, MAP MF-311

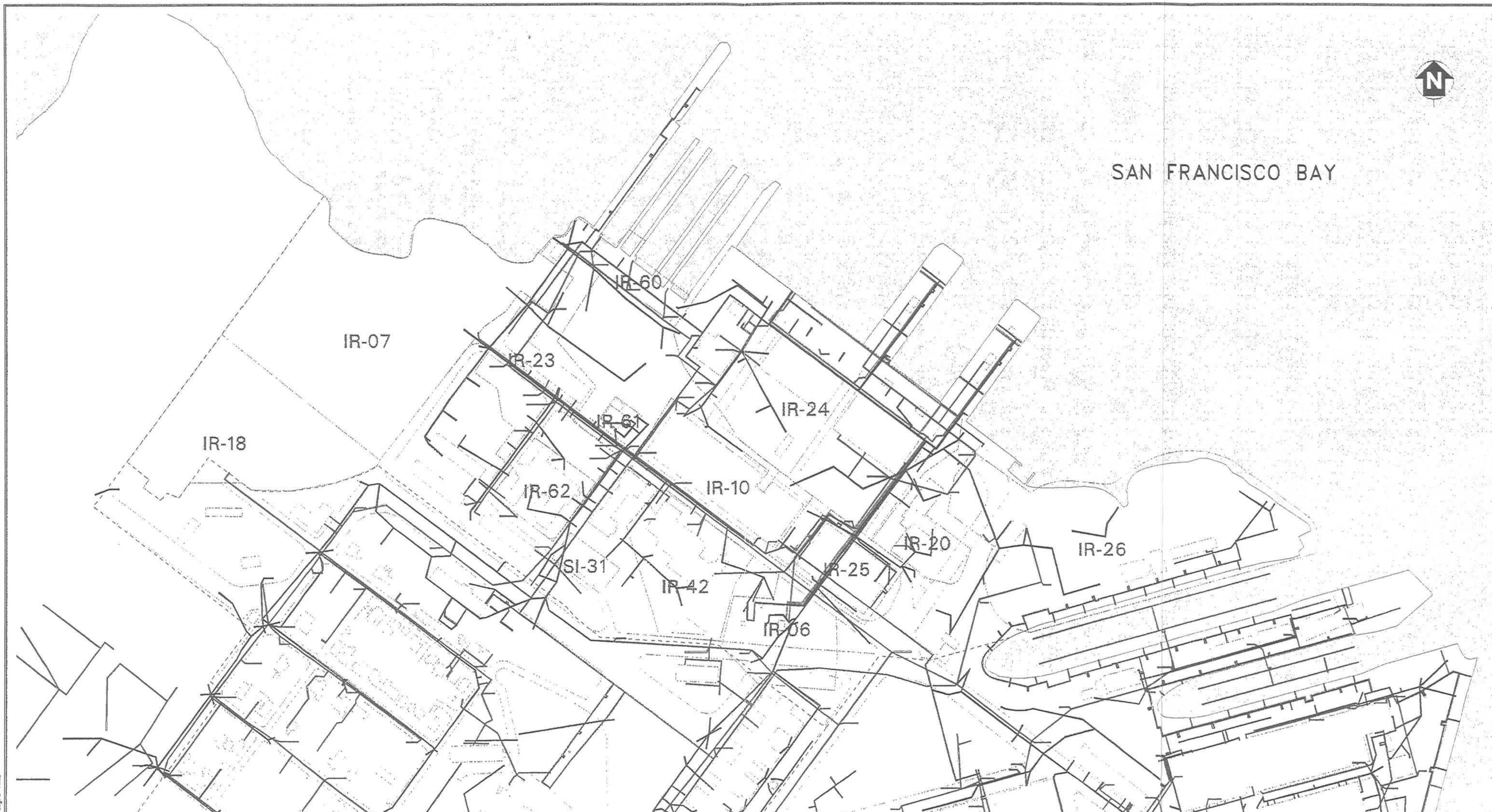
DEPARTMENT OF THE NAVY | NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

HUNTERS POINT SHIPYARD | SAN FRANCISCO, CALIFORNIA

Figure 2-3
Topographic and Geologic Map
Parcel B
Parcel B Feasibility Study



EXPLANATION

- PARCEL BOUNDARY
- IR SITE BOUNDARY
- FUEL LINE
- STEAM LINE
- SANITARY SEWER LINE
- STORM DRAIN LINE

150 0 150 300
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL ACTIVITIES ENGINEERING COMMAND

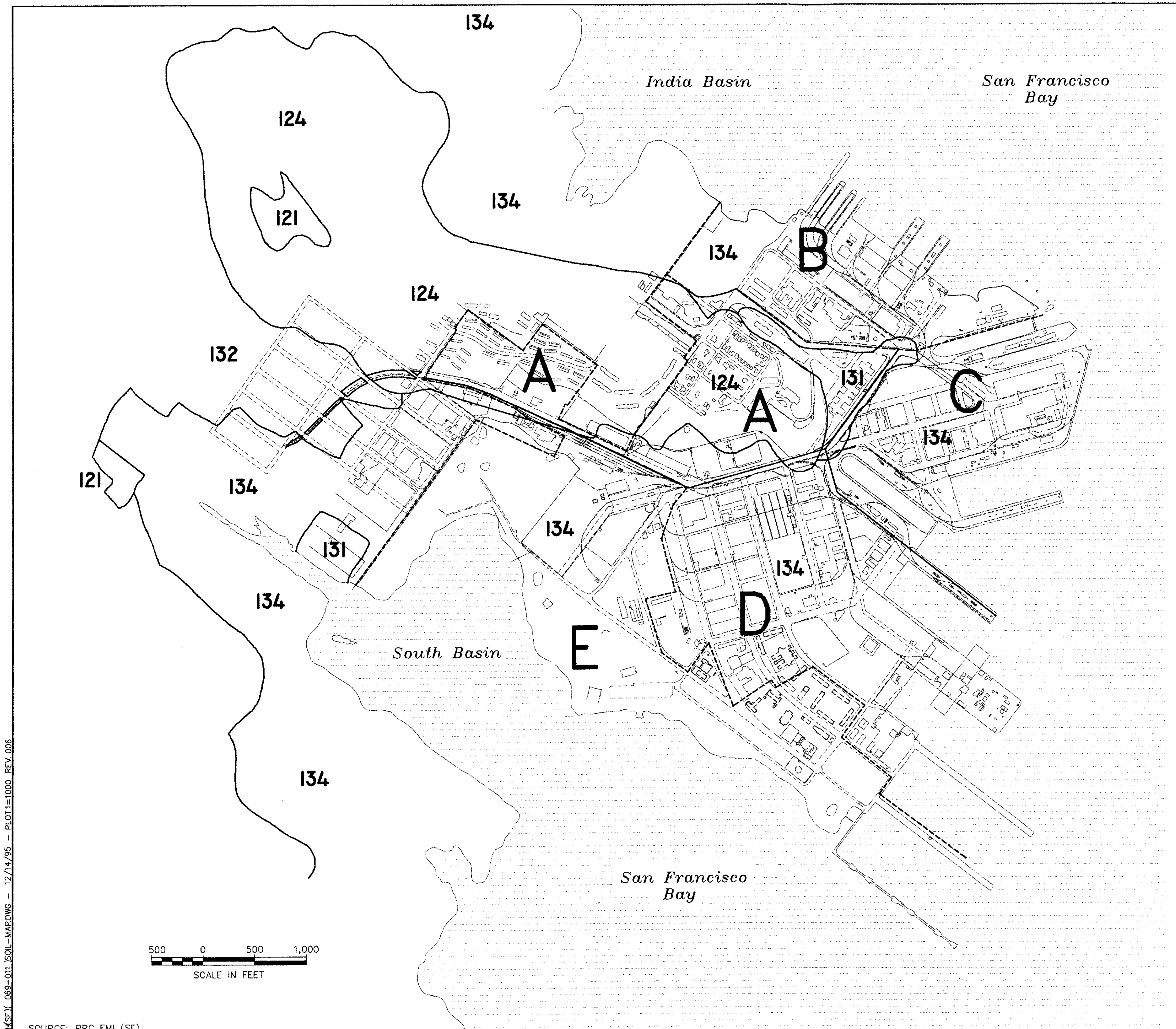
ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

FIGURE 2-4
PARCEL B
LOCATION OF UTILITY LINES
AT HUNTERS POINT SHIPYARD

05/29/96 /data0/hunters/b_util_fs.gra AML



LEGEND

121	Orthents, cut and fill, 0 to 15 percent slopes
124	Orthents, cut and fill to Urban land complex, 5 to 75 percent slopes
131	Urban land
132	Urban land to Orthents, cut and fill complex, 0 to 5 percent slopes
134	Urban land to Orthents, reclaimed complex, 0 to 2 percent slopes
A	PARCEL DESIGNATION
--------	PARCEL DELINEATION

SOURCE : U.S. SOIL CONSERVATION SERVICE, 1991
SOIL SURVEY OF SAN MATEO COUNTY, EASTERN PART, AND SAN FRANCISCO COUNTY, CALIFORNIA

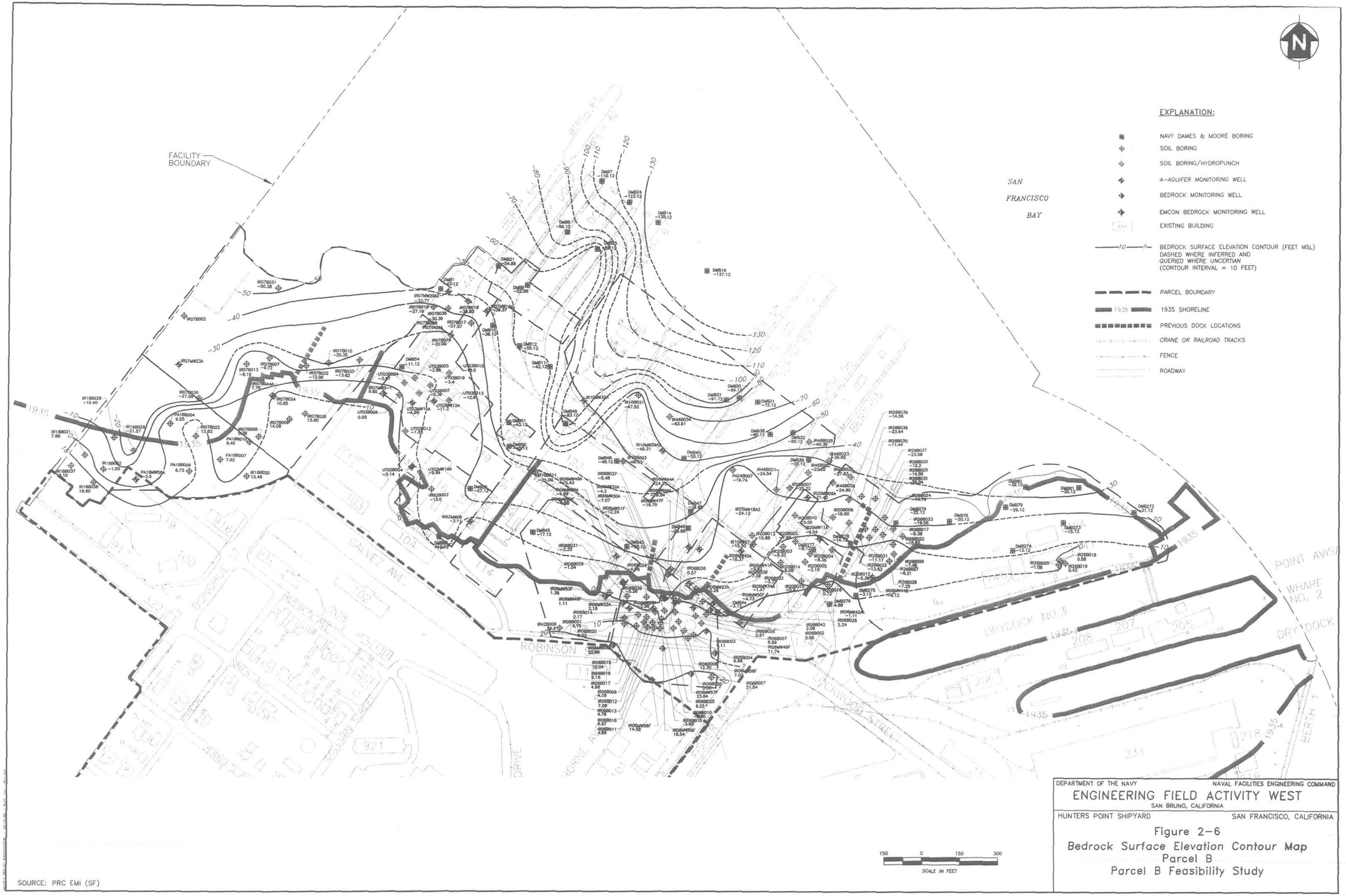
SOURCE: PRC EMI (SF)

KCH(SF) 069-011 SOIL-MAP.DWG - 12/14/95 - PLOT1=1000 REV 006

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
ENGINEERING FIELD ACTIVITY WEST
SAN BRUNO, CALIFORNIA

HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA

Figure 2–5
HPS Soil Distribution Map
Parcel B
Feasibility Study



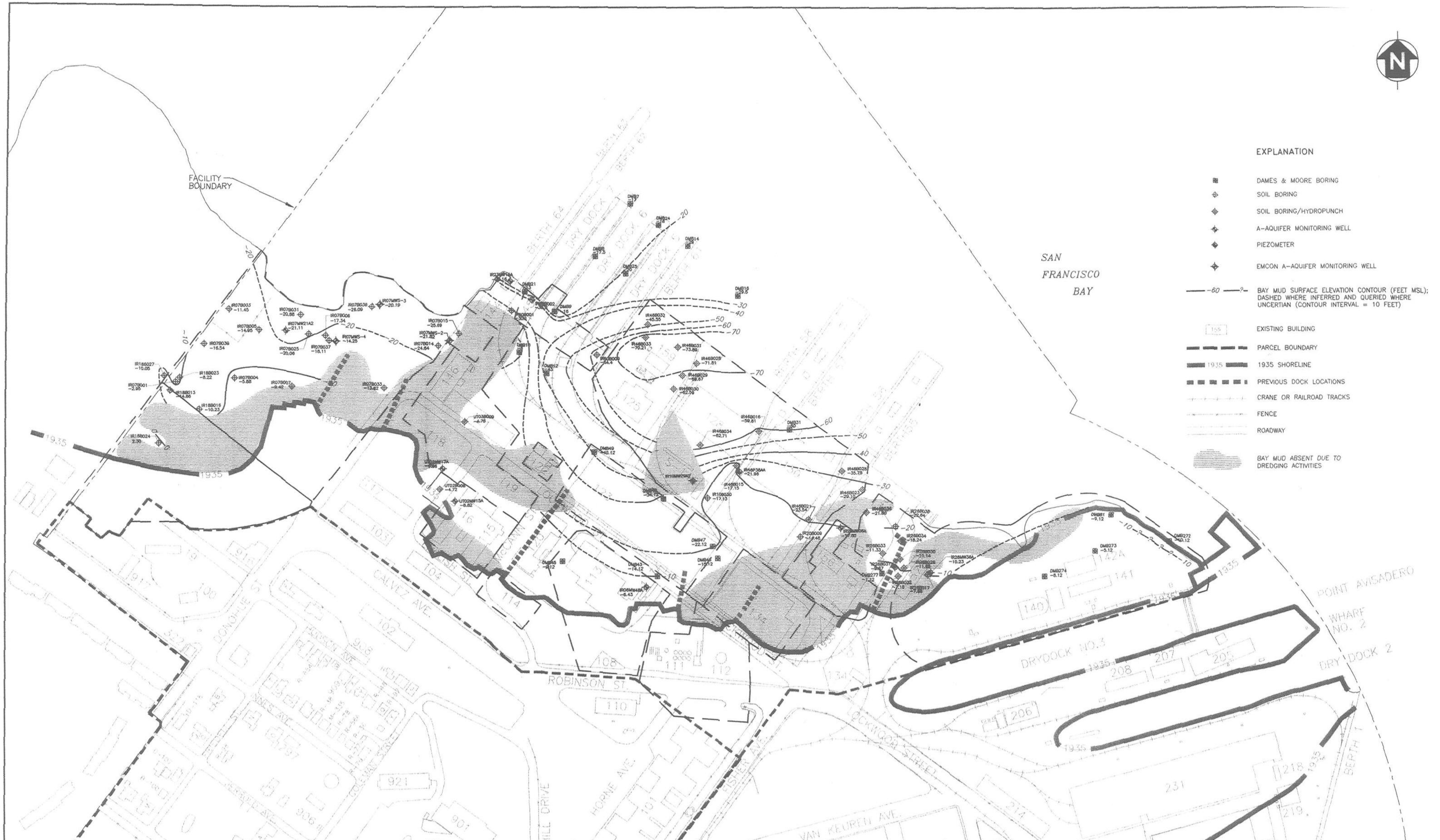
DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

Figure 2–6
Bedrock Surface Elevation Contour Map
Parcel B
Parcel B Feasibility Study



SOURCE: PRC EMI (SF)

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

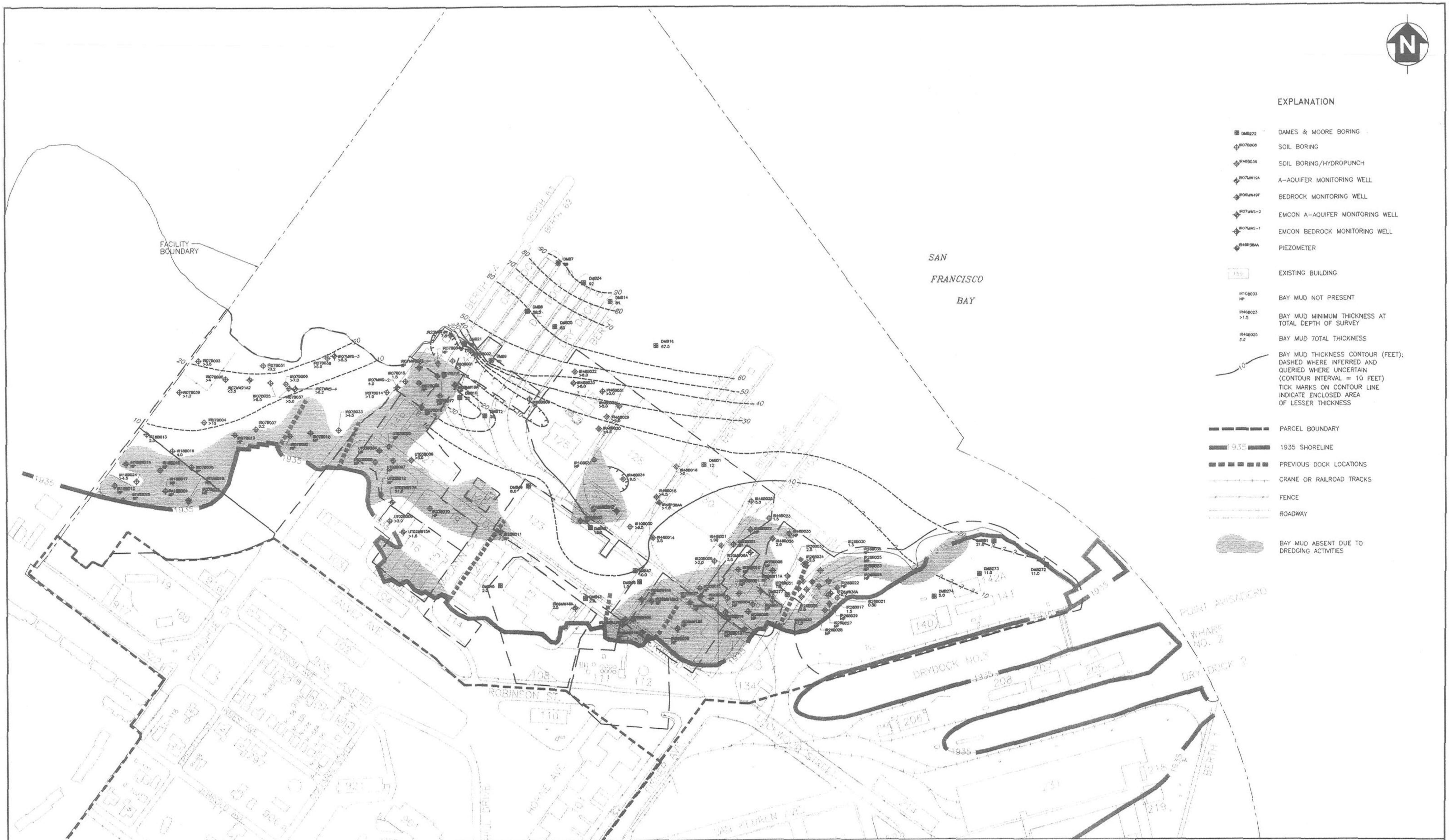
HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA

Figure 2-7

Bay Mud Elevation Contour Map

Parcel B

Parcel B Feasibility Study



NOTE: DAMES & MOORE BORINGS WERE DRILLED IN 1943–1945. CHANGES MAY HAVE OCCURED DUE TO DREDGING AND EMPLACEMENT OF FILL IN THE INTERVENING YEARS

150 0 150 300

SCALE IN FEET

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND

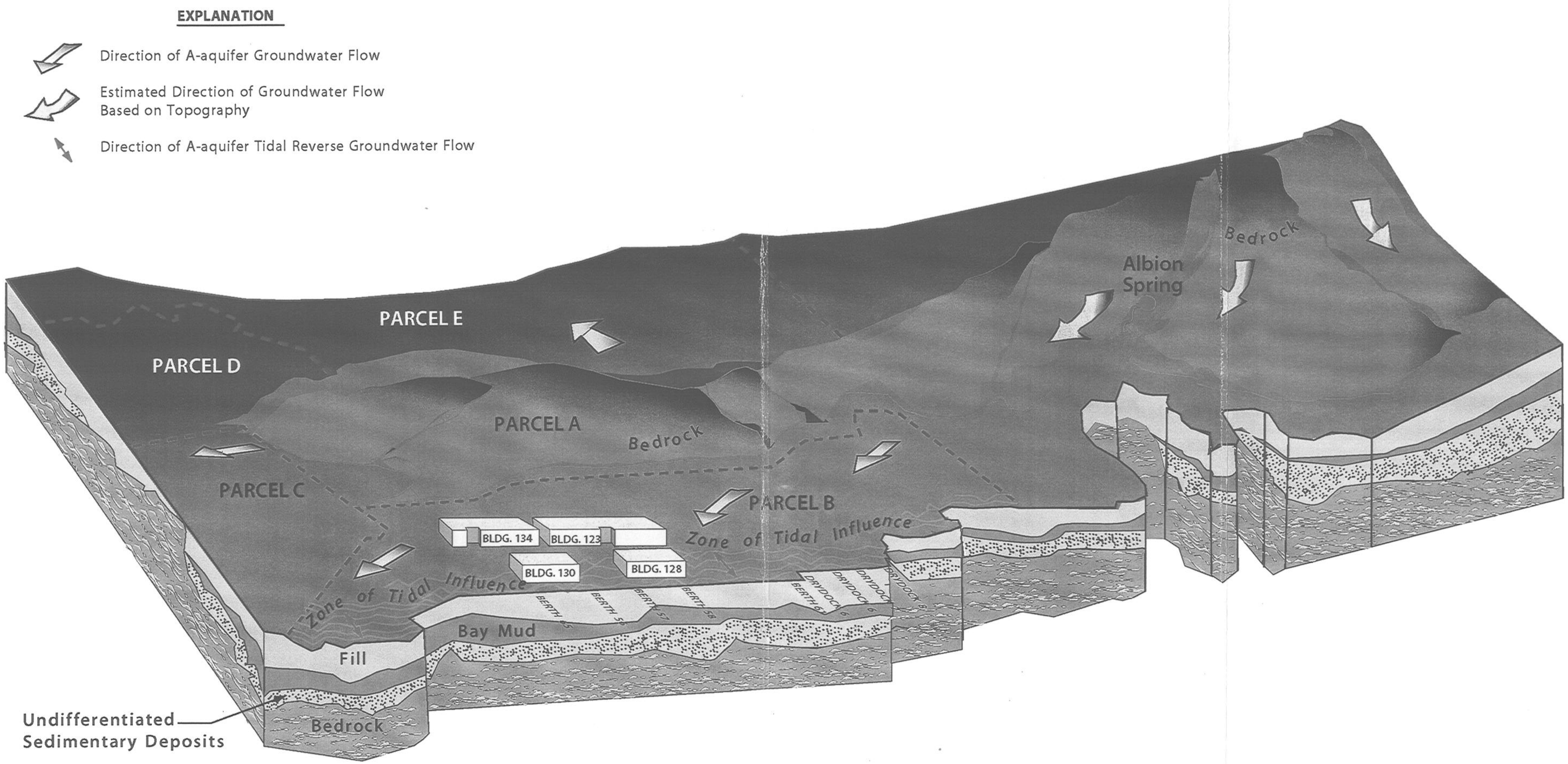
ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA

Figure 2–8
Thickness of Bay Mud Deposits
Parcel B
Parcel B Feasibility Study

SOURCE: PRC EMI (SF)



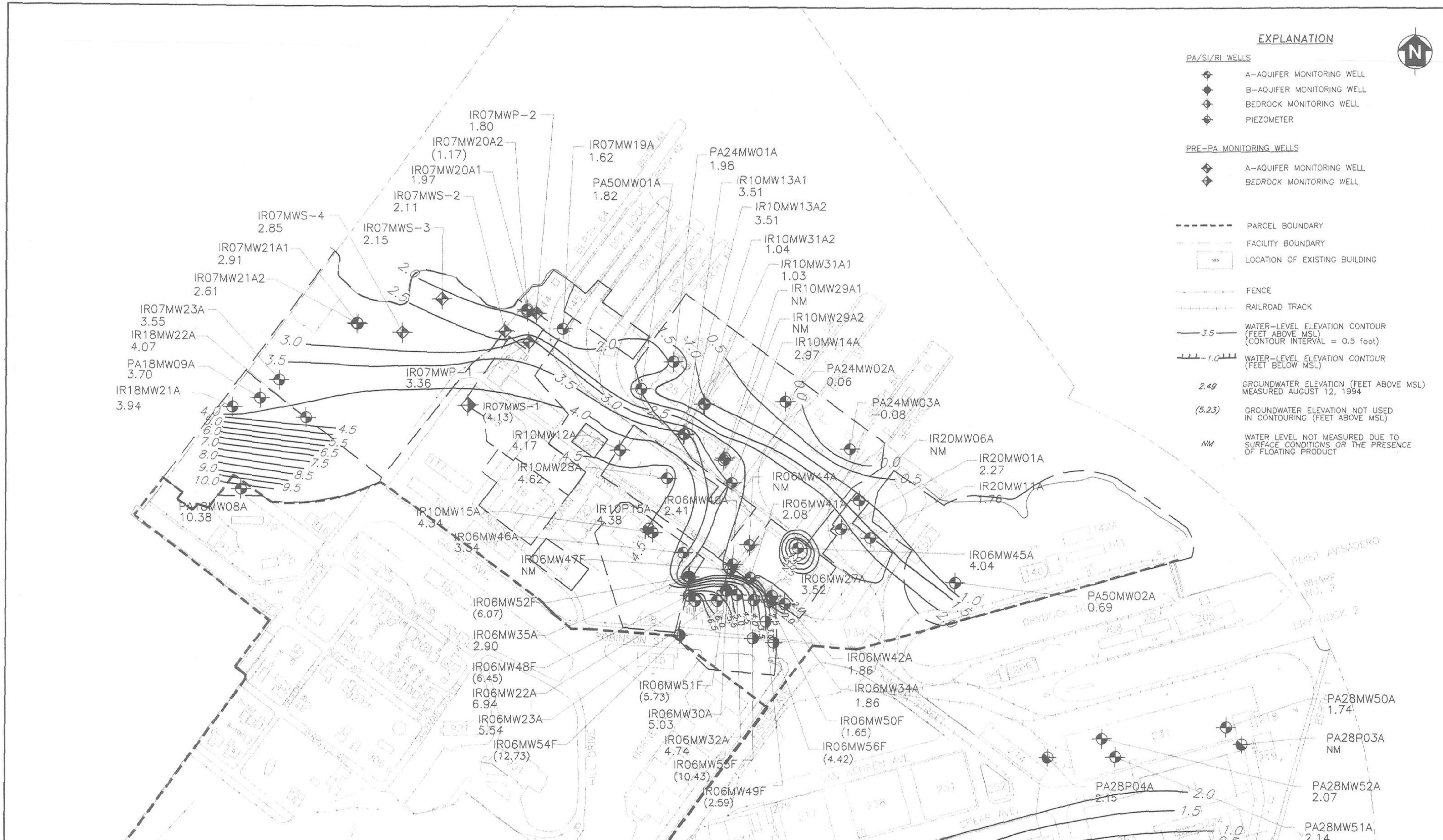
DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA

Figure 2-9
Conceptual Groundwater Flow Model
Hunters Point Shipyard



NOTES:

1) WATER-LEVEL ELEVATION CONTOUR MAPS ARE BASED ON ONE INTERPRETATION OF THE DATA. OTHER INTERPRETATIONS ARE POSSIBLE

2) BECAUSE FACILTY-WIDE GROUNDWATER LEVELS WERE TAKEN OVER A 7-HOUR PERIOD, GROUNDWATER CONTOURS MAY BE AFFECTED IN AREAS WITH TIDAL INFLUENCE

3) THIS MAP IS ADAPTED FROM HARDING LAWSON ASSOCIATES

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

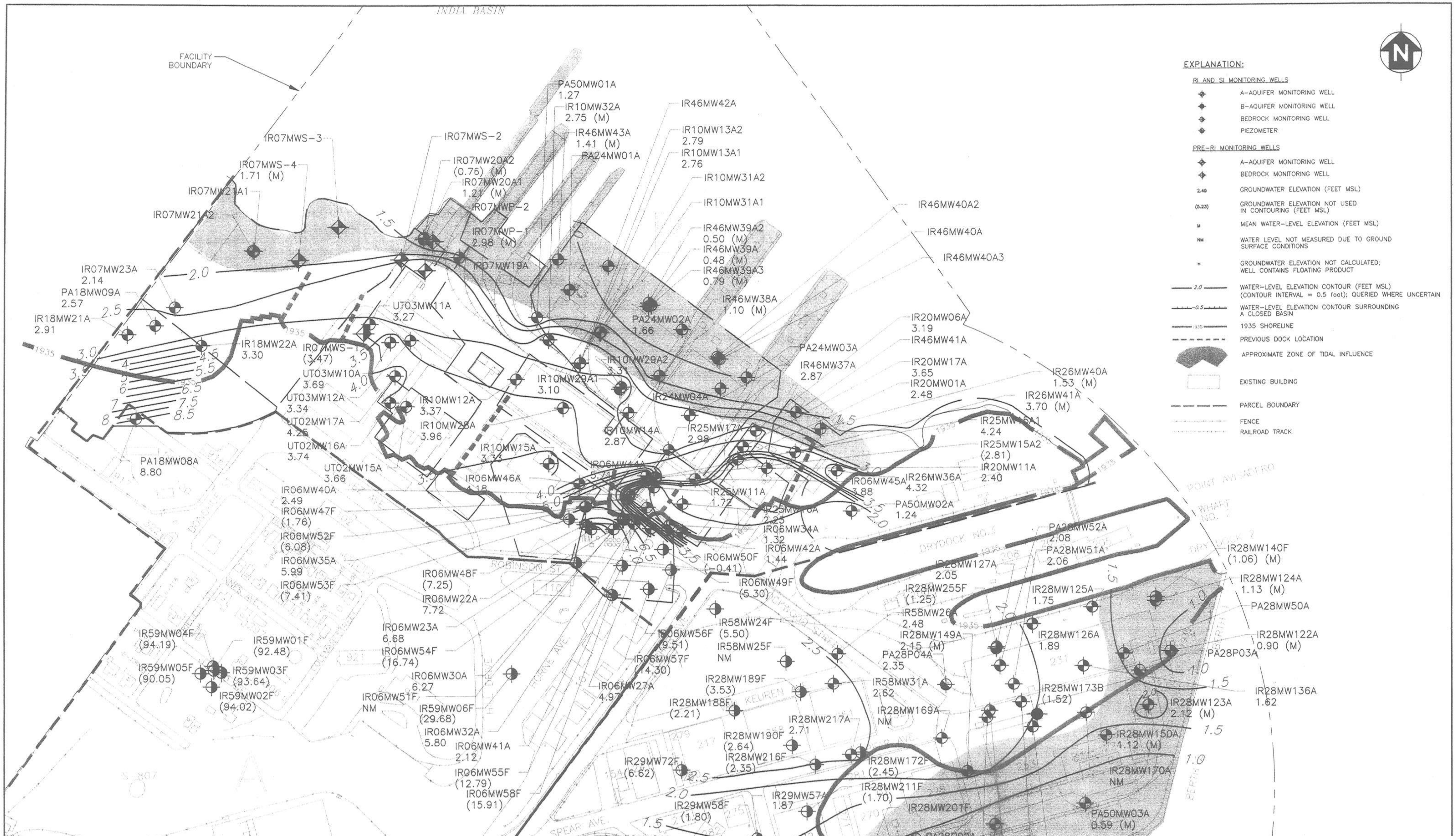
ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

Figure 2-10

Parcel B Groundwater Elevation Map
A-Aquifer February 1994
Parcel B Feasibility Study



NOTES:

1) ALL WATER LEVELS WERE MEASURED MAY 22, 1995
2) WATER-LEVEL ELEVATION CONTOUR MAPS ARE BASED ON ONE INTERPRETATION OF THE DATA. OTHER INTERPRETATIONS ARE POSSIBLE
3) BECAUSE FACILTY-WIDE GROUNDWATER LEVELS WERE TAKEN OVER A 7.5-HOUR PERIOD, GROUNDWATER CONTOURS MAY BE AFFECTED IN AREAS WITH TIDAL INFLUENCE. TIDAL FLUCTUATION OBSERVED DURING DATA COLLECTION PERIOD RANGED FROM 0.6 TO 5.2 FEET MSL
4) MEAN WATER-LEVEL ELEVATIONS WERE CALCULATED USING HOURLY MEASUREMENTS COLLECTED OVER A 72-HOUR PERIOD AND METHODOLOGY DESCRIBED BY SERFES (1991). IN PARCELS B AND C, ONLY MEAN WATER-LEVEL ELEVATIONS ARE POSTED AND CONTOURED IN AREAS OF KNOWN TIDAL INFLUENCE
5) THIS MAP IS ADAPTED FROM HARDING LAWSON ASSOCIATES

SOURCE: PRC EMI (SF)

150 0 150 300
SCALE IN FEET

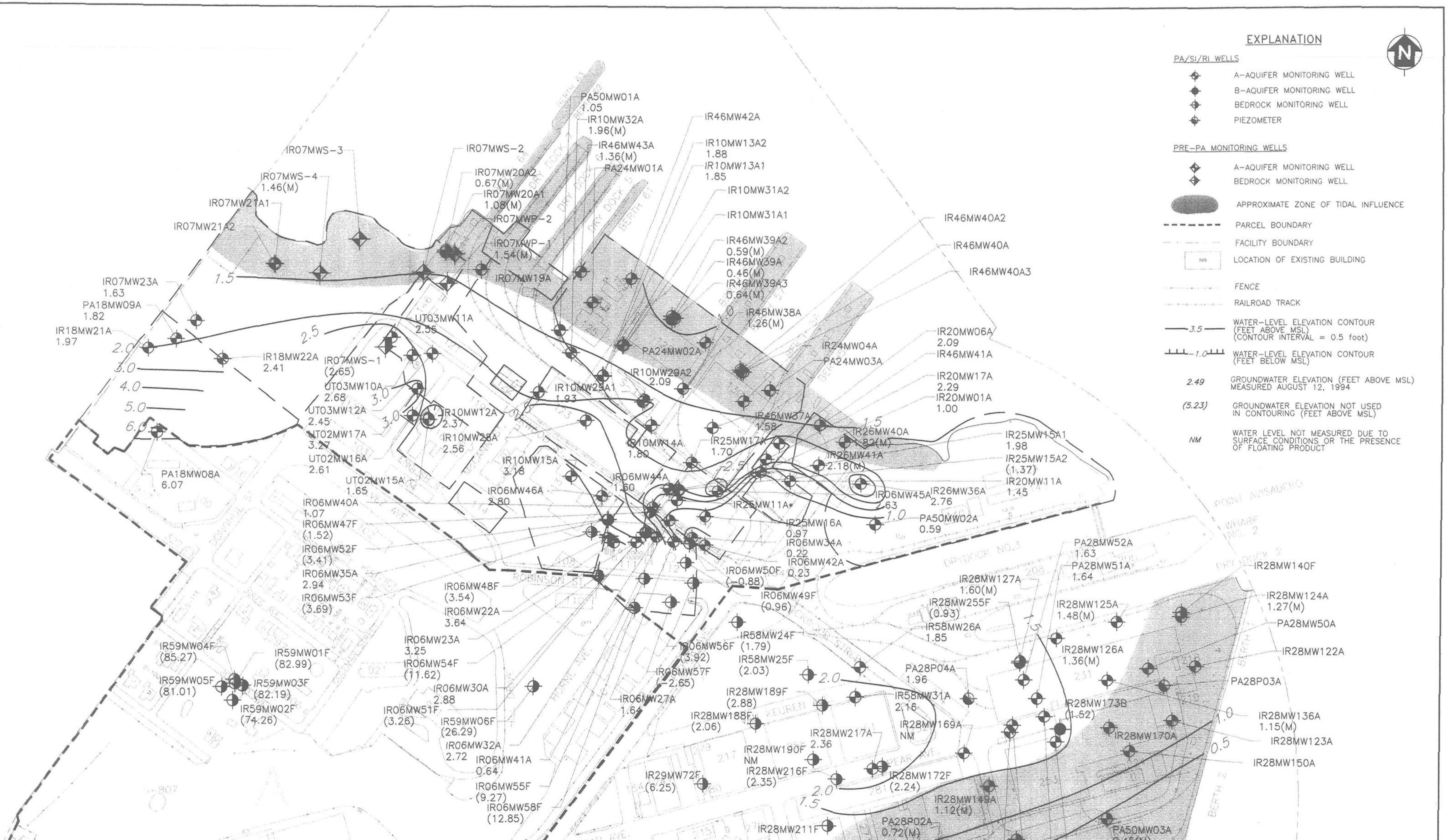
DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

Figure 2-11
Parcel B Groundwater Elevation Map
(Includes Mean Water Levels)
A-Aquifer May 1995
Parcel B Feasibility Study



NOTES:

1) ALL WATER LEVELS WERE MEASURED NOVEMBER 3, 1995

2) BECAUSE FACILTY-WIDE GROUNDWATER LEVELS WERE TAKEN OVER A 7-HOUR PERIOD, GROUNDWATER CONTOURS MAY BE AFFECTED IN AREAS WITH TIDAL INFLUENCE. TIDAL FLUCTUATION OBSERVED DURING DATA COLLECTION PERIOD RANGED FROM 1.7 TO 6.9 FEET ABOVE MSL

3) THIS MAP IS ADAPTED FROM HARDING LAWSON ASSOCIATES

4) MEAN WATER-LEVEL ELEVATIONS WERE CALCULATED USING HOURLY MEASUREMENTS TAKEN OVER A 72-HOUR PERIOD AND METHODOLOGY DESCRIBED BY SERFES (1991). IN PARCELS B AND C, ONLY MEAN WATER-LEVEL ELEVATIONS ARE POSTED AND CONTOURED IN AREAS OF KNOWN TIDAL INFLUENCE

150 0 150 300
SCALE IN FEET

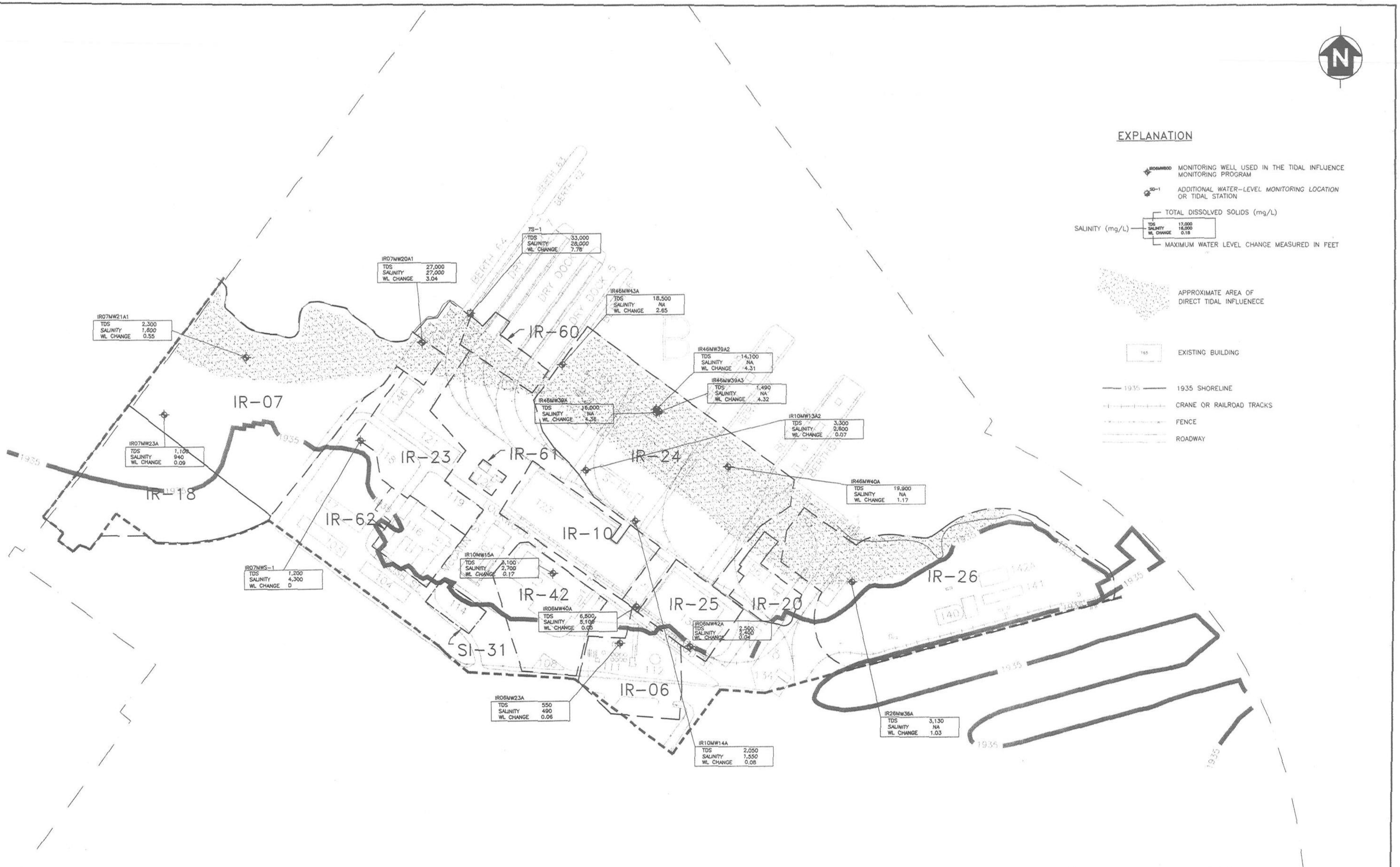
DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

Figure 2-12
Parcel B Groundwater Elevation Map
A-Aquifer November 1995
(Includes Mean Water Levels)
Parcel B Feasibility Study



NOTES:

(1) THE POSTED TDS, SALINITY, AND WATER LEVEL CHANGE DATA ARE THE MAXIMUM VALUES FROM ALL TIDAL INFLUENCE MONITORING EVENTS.

(2) THE SALINITY RESULTS WERE DETERMINED USING STANDARD METHOD 2520B, WHICH USES SOLUTION ELECTRICAL CONDUCTIVITY TO APPROXIMATE SALINITY. THE RESULTS WERE REPORTED BY THE LABORATORY IN TERMS OF THE PRACTICAL SALINITY SCALE, WHICH CAN BE CONSIDERED AN APPROXIMATION OF PARTS PER THOUSANDS. FOR COMPARISON WITH THE TDS RESULTS, SALINITY RESULTS ARE PRESENTED ON THIS PLATE WERE DETERMINED USING EPA METHOD 160.1 (RESIDUE FILTERABLE GRAVIMETRIC) AND WERE REPORTED BY THE LABORATORY IN MILLIGRAMS PER LITER (mg/L) OR PARTS PER MILLION.

ABBREVIATIONS

TDS	TOTAL DISSOLVED SOLIDS
TS	TIDAL STATION
NA	NOT ANALYZED
D	DATA LOGGER OR TRANSFORMER MALFUNCTION – NO DATA

SOURCE: PRC EMI (SF)

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

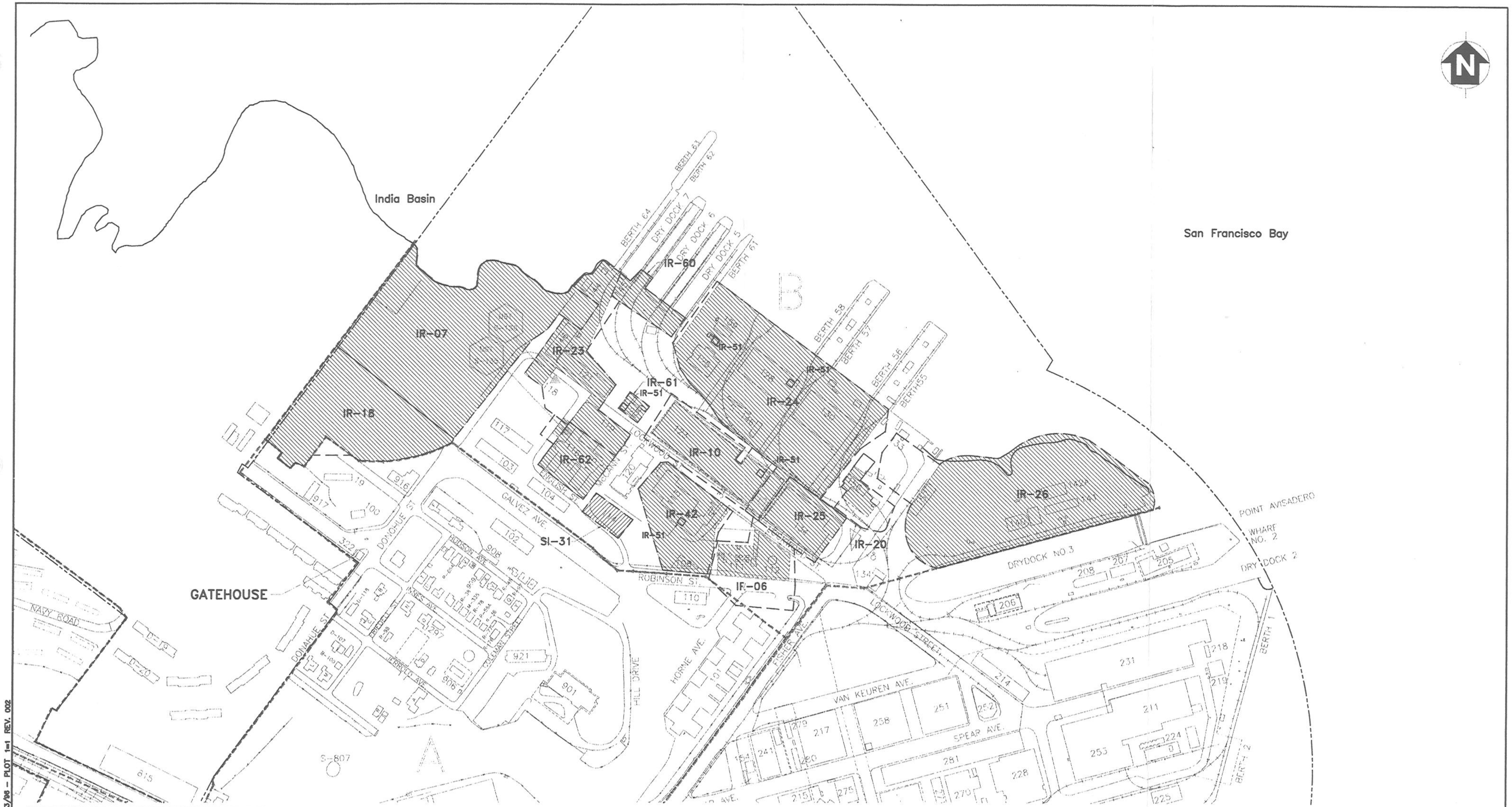
ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

Figure 2-13

Tidal Influence Monitoring Results Maximum Water-Level Change, TDS, and Salinity at Tidal Influence Monitoring Locations Parcel B Feasibility Study



LEGEND

- PARCEL BOUNDARY
- FACILITY BOUNDARY
- IR SITE EXTENDED BOUNDARY FOR RISK ASSESSMENT PURPOSES
- IR SITE BOUNDARY
- SI SITE BOUNDARY
- UST LOCATION & DESCRIPTION

Note: IR-45, IR-46 AND IR-50 ARE UTILITY SITES AND ARE SHOWN ON UTILITY DRAWINGS 3.1-1.

100 0 100 200
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
ENGINEERING FIELD ACTIVITY WEST
SAN BRUNO, CALIFORNIA

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

Figure 2-14
Parcel B Map
Parcel B Feasibility Study

TABLE 2-1

PARCEL B HISTORICAL AND CURRENT BUILDING USE

Site	Bldg No.	Area (ft^2)	Former Shipyard Use (1940 to 1974)[a]	Current Use[b]	Current Tenant
NA	103	14,194	Submarine Barracks	Art activities	J. Terzian
NA	104	14,194	Naval Reserve Armory	Art activities	J. Terzian
IR-42	109	4,448	Police Station	Office space	EFA WEST
IR-42	113	13,100	Tug Maintenance and Salvage Diver's Shop	Storage	City and County of San Francisco Police Department
IR-42	113A	14,194	Machine Shop, Torpedo Maintenance Shop, Tug Maintenance Shop, Electrical Substation	Q & RA nondestructive test facility	Smith-Emery Co.
IR-62	115	13,684	Submarine Office and Training School	Cabinet making and storage	Finish Works
IR-62	116	18,439	Submarine Subsistence and Training Building	Picture framing	Frame Works
IR-62	117	14,194	Submarine Barracks	Art activities	J. Terzian
IR-62	120	14,008	Enlisted Men's Club	Athletic facility	Police Athletic Club
IR-61	122	3,232	Electrical Substation V and Compressor Plant	Electrical substation	EFA WEST
IR-10	123	77,178	Battery Overhaul and Electroplating, and Storage	Electrical substation	EFA WEST
IR-24	125	10,416	Submarine Cafeteria	Cabinet making workshop, offices, and storage	Bridenthal Cabinetry
IR-24	128	24,120	Shop Service and Work Control Center No. 1	Storage	City and County of San Francisco Police Department
IR-25	134	51,716	Machine Shop, Q & RA Offices, Central Tool Room	Marine refrigeration	Odaco, Inc.
NA	135	2,200	Electrical Substation	Electrical substation	EFA WEST
IR-23	146	9,750	Industrial and Photo Laboratory, and TACAN Facility	Environmental supply storage	EFA WEST

Notes:

ft^2	Square foot
EFA WEST	Engineering Field Activity West
NA	Not applicable
Q&RA	Quality and Reliability Assurance
TACAN	Tactical Air Navigation
a	HPS was deactivated in 1974.
b	Only buildings currently used are listed.

TABLE 2-2

GEOLOGIC UNITS AT PARCEL B

Site	Geologic Unit[a]	Thickness (feet)	Description	Hydrogeologic Unit[a]	Depth to Groundwater (feet bgs)[b]
IR-06	Artificial Fill (Qaf)	Up to 15	Clays, clayey sand, sand with local cobble/boulder fill	A-aquifer	3 to 12
	Undifferentiated Upper Sand Deposits (Quus)	Up to 12	Local poorly-graded sand; limited to northern most part of site		
	Bay Mud Deposits (Qbm)	Up to 3	Clay with trace of shell fragments; present only in extreme northern part of site	Aquitard	NA
	Colluvium/Alluvium (Qc/Qal)	13	Clayey sand, clays; southern margin of site	Not determined	Unsaturated
	Franciscan Complex Bedrock (Kjf)	Unknown	Serpentinite with minor greenstone, siltstone and shale	Bedrock water-bearing zone	4 to 39
IR-07	Artificial Fill (Qaf)	3 to 50	Clayey sands, sand with local cobble/boulder fill	A-aquifer	7 to 14
	Undifferentiated Upper Sand Deposits (Quus)	Up to 7	Poorly-graded sand; very limited extent		
	Bay Mud Deposits (Qbm)	Up to 25	Clay with trace of shell fragments	Aquitard	NA
	Franciscan Complex Bedrock (Kjf)	Unknown	Serpentinite and greenstone	Bedrock water-bearing zone	6 to 8
IR-10	Artificial Fill (Qaf)	20 to 60	Clayey sands, sands with local cobble/boulder fill	A-aquifer	5 to 11
	Undifferentiated Upper Sand Deposits	Up to 11	Poorly-graded sand; very limited extent	A-aquifer	
	Bay Mud Deposits (Qbm)	Up to 10	Local clay with trace of shell fragments	Aquitard	NA
	Franciscan Complex Bedrock (Kjf)	Unknown	Serpentinite, minor weathered greenstone	Bedrock water-bearing zone	Unknown

TABLE 2-2 (Continued)

GEOLOGIC UNITS AT PARCEL B

Site	Geologic Unit[a]	Thickness (feet)	Description	Hydrogeologic Unit[a]	Depth to Groundwater (feet bgs)[b]
IR-18	Artificial Fill (Qaf)	2 to 25	Clayey sands, sand with local cobble/boulder fill, minor concrete debris	A-aquifer	13 to 18
	Undifferentiated Upper Sand Deposits (Quus)	1 to 9	Poorly-graded sand	A-aquifer	13 to 18
	Bay Mud Deposits (Qbm)	3 to 5	Clay with trace of shell fragments (noncontiguous - absent at southern portion of site)	Aquitard	NA
	Undifferentiated Sedimentary Deposits (Qu)	5 to 30	Poorly-graded sand	Not determined	(see A-aquifer above)
	Franciscan Complex Bedrock (Kjf)	Unknown	Fractured serpentinite	Bedrock water-bearing zone	Unknown
IR-20	Artificial Fill (Qaf)	10 to 27	Clayey sands, sand with local cobble/boulder fill	A-aquifer	6 to 9
	Undifferentiated Upper Sand Deposits (Quus)	Up to 2	Local poorly-graded sand (noncontiguous)		
	Bay Mud Deposits (Qbm)	Up to 3	Clay with trace of shell fragments (present only near IR20B009 and IR20MW06A)	Aquitard	NA
	Undifferentiated Sedimentary Deposits (Qu)	Up to 2	Local poorly-graded sand (noncontiguous)	Not determined	(see A-aquifer above)
	Franciscan Complex Bedrock (Kjf)	Unknown	Fractured serpentinite	Bedrock water-bearing zone	Unknown

TABLE 2-2 (Continued)

GEOLOGIC UNITS AT PARCEL B

Site	Geologic Unit[a]	Thickness (feet)	Description	Hydrogeologic Unit[a]	Depth to Groundwater (feet bgs)[b]
IR-23	Artificial Fill (Qaf)	2 to 25	Clayey sands, sand with local cobble/boulder fill (total thickness unknown - entire unit not penetrated)	A-aquifer	5 to 10
	Undifferentiated Upper Sand Deposits (Quus)	Up to 1	Local poorly-graded sand (noncontiguous)		
	Bay Mud Deposits (Qbm)	Unknown	Clay and silt (present only at small area near Building 121; entire unit not penetrated)	Aquitard	NA
	Franciscan Complex Bedrock (Kjf)	Unknown	Serpentinite	Bedrock water-bearing zone	Unknown
IR-24	Artificial Fill (Qaf)	12 to 30	Clayey sands, sand with local cobble/boulder fill (unknown whether Bay Mud unit underlies Artificial Fill at site)	A-aquifer	8 to 19
	Franciscan Complex Bedrock (Kjf)	Unknown	Fractured Serpentinite	Bedrock water-bearing zone	Unknown
IR-25	Artificial Fill (Qaf)	20 to 31	Clayey sands, sand with local cobble/boulder fill	A-aquifer	3 to 10
	Undifferentiated Upper Sand Deposits (Quus)	1 to 6	Sand (Bay Mud unit removed during dredging)		
	Undifferentiated Sedimentary Deposits (Qu)	Up to 10	Clayey sand		
	Franciscan Complex Bedrock (Kjf)	Unknown	Serpentinite	Bedrock water-bearing zone	Unknown

TABLE 2-2 (Continued)

GEOLOGIC UNITS AT PARCEL B

Site	Geologic Unit[a]	Thickness (feet)	Description	Hydrogeologic Unit[a]	Depth to Groundwater (feet bgs)[b]
IR-26	Artificial Fill (Qaf)	7 to 35	Sands and clayey sands; with clays and silty clays at western portion of site	A-aquifer	3 to 9
	Undifferentiated Upper Sand Deposits (Quus)	1 to 3	Clayey sands with trace of shell fragments and gravel		
	Bay Mud Deposits (Qbm)	2 to 4	Sandy clay with trace of shell fragments and gravel (noncontiguous - present at northern portion of site only)	Aquitard	NA
	Franciscan Complex Bedrock (Kjf)	Unknown	Fractured Serpentinite	Bedrock water-bearing zone	Unknown
IR-46	Artificial Fill (Qaf)	32 to 82	Clays, clayey sands, sand with local cobble/boulder fill	A-aquifer	8 to 9
	Undifferentiated Upper Sand Deposits (Quus)	1 to 7	Local silty sand (noncontiguous)		
	Bay Mud Deposits (Qbm)	1 to > 4	Clay with trace of shell fragments and fine-grained sand	Aquitard	NA
	Undifferentiated Sedimentary Deposits (Qu)	> 4	Clayey sand (fine-grained sand)	Not determined	Unknown
	Franciscan Complex Bedrock (Kjf)	Unknown	Serpentinite	Bedrock water-bearing zone	Unknown

TABLE 2-2 (Continued)

GEOLOGIC UNITS AT PARCEL B

Site	Geologic Unit[a]	Thickness (feet)	Description	Hydrogeologic Unit[a]	Depth to Groundwater (feet bgs)[b]
IR-60	Artificial Fill (Qaf)	42 to 78	Clayey and sandy gravels, sands with local clay lenses	A-aquifer	9 to 10
	Undifferentiated Upper Sand Deposits (Quus)	5	Fine- to medium-grained sand with trace of silt and shell fragments		
	Bay Mud Deposits (Qbm)	42 to 78	Silty clay with fine-grained sand lenses and shell fragments	Aquitard	NA
	Franciscan Complex Bedrock (Kjf)	Unknown	Serpentinite (bedrock not encountered during drilling at site)	Bedrock water-bearing zone	Unknown
IR-61	Artificial Fill (Qaf)	10 to 53	Clay and sandy gravels, sands with local clay lenses and cobble/boulder fill	A-aquifer	2 to 10
	Undifferentiated Sedimentary Deposits (Qu)	Unknown	Sand, silty sand, gravel with trace of shell fragments (entire unit not penetrated; however, unit is at least 8 feet thick)		
	Franciscan Complex Bedrock (Kjf)	Unknown	Serpentinite (bedrock not encountered during drilling at site)	Bedrock water-bearing zone	Unknown
IR-62	Artificial Fill (Qaf)	12 to 26	Clayey and sandy gravel, sand with local clay lenses	A-aquifer	6 to 10
	Bay Mud Deposits (Qbm)	Unknown	Clay (noncontiguous - encountered only near UT02B008)	Aquitard	NA
	Undifferentiated Sedimentary Deposits (Qu)	2 to 4	Very fine to fine-grained silty sand with trace of clay and shell fragments	Not determined	(see A-aquifer above)
	Franciscan Complex Bedrock (Kjf)	Unknown	Fractured Serpentinite	Bedrock water-bearing zone	Unknown

Continue

TABLE 2-2 (Continued)

GEOLOGIC UNITS AT PARCEL B

Notes:

a	Geologic and hydrogeologic units for each IR site are listed from top (youngest) to bottom (oldest)
b	"Unknown" = monitoring wells not installed in aquifer
bgs	below ground surface
NA	Not applicable